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A DECADE OF VERTEBRATE PEST MANAGEMENT RESEARCH IN AGRICULTURAL LANDSCAPE OF ASSAM



ALL INDIA NETWORK PROJECT ON VERTEBRATE PEST MANAGEMENT,
ASSAM AGRICULTURAL UNIVERSITY-ZONAL RESEARCH STATION,
NORTH LAKHIMPUR

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PREFACE

Assam is known for its rich biodiversity is blessed with fertile agricultural landscapes. Extensive studies across Assam's agro-ecosystem reveals exceptionally rich faunal diversity. With its unique climatic conditions, diverse ecosystems and expanding agricultural activities Assam faces a serious threat from vertebrate pests resulting in direct conflict with the livelihood of the marginal and small farmers. Vertebrate pest in Assam covers birds, rodents, squirrel, wild boar and monkey that cause damage to crops, nurseries, orchards and stored grain products. Rodents cause extensive damage in rice fields, plantations and granaries. Similarly, pest such as birds, rhesus monkey and wild boar feeds on critical growth stages eventually reducing the yield value.

A Brief Background of the project: The Project All India Network Project (AINP) on Vertebrate Pest Management (VPM) (erstwhile “*AINP on Agricultural Ornithology*”) was implemented at Assam Agricultural University (AAU), Jorhat campus from April 2009 during the XI five Year Plan vide ADG (PP), ICAR, New Delhi Sanction Letter no. (F. No. 10-1/2009-PP Dated 29- 01-2009) The Project was transferred to AAU- Zonal Research Station, North Lakhimpur (Erstwhile RARS, Lakhimpur,) on 13th November 2009 vide Hon'ble Vice Chancellor, AAU Order No. 17401 dated 13th November 2009 with one sanctioned post of Scientist .

In recent years, the damage caused by higher vertebrates' viz., the Rhesus Macaques and wild boar has become a matter of serious concern as they are reported to cause significant crop damage ($\geq 50\%$). Also, the avian biodiversity (Depredatory and predatory) are the assets of Assam in their aesthetic beauty and biological management. ICAR had taken an initiative to address these issues by merging two existing AINPs on Rodent control and Agricultural Ornithology and added a new component of higher Vertebrates. The project has three components namely (a) Rodent Control (b) Agricultural Ornithology (c) Higher Vertebrates. A MoU between ICAR and Assam Agricultural University became effective from 18/02/2015 and agree to co-operate in conducting research through AINP on VPM scheme sanctioned by the ICAR UNDER XII Plan with unique agency code AAU

Study in vertebrate pest management will highlight the importance of understanding pest biology, population dynamics and ecological interactions which in return will help to design practical and sustainable solution. By creating awareness and encouraging farmers for adoption of the technologies will not only protect the crops from vertebrate pest but will also foster a harmonious coexistence between humans and wildlife.

It is hoped that this research work will inspire continued collaboration and innovation in the field of vertebrate pest management and serve as useful reference for students, researchers, agricultural professionals and policy makers engaged in addressing the challenges of vertebrate pests in Assam.

13th March, 2026
North Lakhimpur

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Chapter-1

HABITAT ANALYSIS AND DISTRIBUTION OF VERTEBRATE PESTS

For developing ecologically informed pest managements strategies in different Agro-ecosystem of Assam, clear understanding of the habitat associations, distribution pattern and population dynamics of vertebrate pest is fundamental. Assam's rich Agro-biodiversity attributed mainly to wide variation in the physiographic and Agro-climatic conditions, diverse landscape support varying assemblages of rodents, birds and other higher vertebrates like monkey and wild boar. The changing land use pattern, crop intensification and proximity to natural habitats have reshaped vertebrate communities, influencing pest pressure and crop vulnerability

I. BIRD SURVEY AND CENSUS

Bird survey was conducted using a field binocular (8x40). Photographs were taken whenever necessary. Identification was done using standard field guides (Grimmet *et al*; 1999). Bird census was also conducted in different seasons in the different agro-ecosystems of Rice-Rice, Rice-Mustard, Rice-Maize , Tea, Maize, homestead garden and open grassland as well as wetlands adjacent to paddy field were selected to study the bird communities using Point count method(Hostetler and Main, 2001). Observations were made between 7:00 and 9:00 A.M. Shannon-Wiener Index of Diversity and Evenness was calculated using the Windows based software Biodiversity Professional.

SIGNIFICANT ACHIEVEMENTS:

The community structure of birds and their study conducted in paddy – mustard cropping system during the *rabi* season and in homestead garden (2015-17) reveals a total of 17 species of bird were recorded in mustard ecosystem. Common myna and jungle myna were found to be predominant species followed by white wagtail, shrike, stonechat and plaintive cuckoo among the predatory omnivorous and insectivorous. Species richness was found to be more in early maturity stage followed by pod formation stage of mustard crop sown after harvesting of *Sali* rice. Shrikes were found to feed voraciously Mustard aphids whereas Plaintive cuckoo and the mynas feeds on mustard sawfly larvae. Green bee eaters were found to catch honey bees. 31 spp of birds recorded with 2.44 diversity index. 3 spp of Barbet in homestead eco system was recorded Barbet's feeding, nesting and breeding ecology was studied. Four spp recorded in study area (RARS, NL), Spotted Dove was the most abundant followed by Rock Pigeon. Population was more in the month of February. Among the spp only Green Pigeon preferred uncultivated area with indigenous trees

Table. 1. Birds' community in paddy- mustard cropping system 2015-17

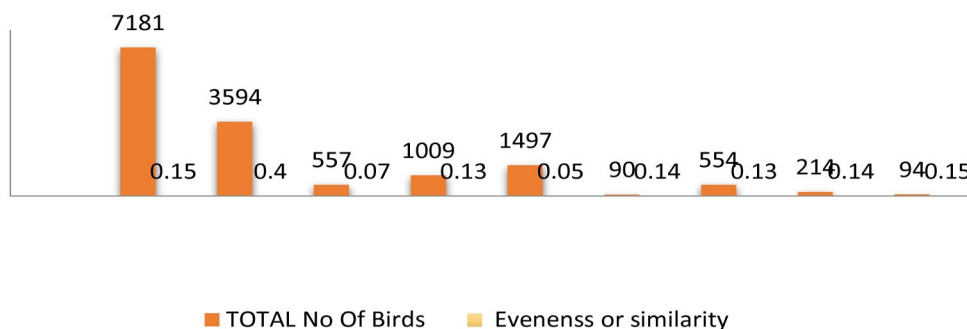
Bird Species	% abundance
1.Plaintive cuckoo	1.52
2.Black Drongo	3.99
3.Green bee eater	2.85
4.Common Myna	37.64
5.Jungle myna	19.01
6.Pied myna	11.78
7.cattle egret	1.40
8.Red wattled Lapwing	1.40
9.Whitebreasted kingfisher	1.40
10.shrike	2.09
11.white wagtail	3.42
12.Spotted Dove	6.08
13.Common kestrel	0.57
14.Red vented bulbul	0.95
15.Barn swallow	4.56
16.Grass bird	0.19
17.Stonechat	1.9

Table.2. Species richness in different crop stages of mustard

Crop growth stages	Species richness
Early vegetative	14
Late vegetative	11
Flowering	8
Pod formation	13

Studies on community structure of birds and their diversity in relation to crop stages in UBVZ and NBPZ was conducted in different districts of UBVP and NBP zones of Assam in Rice/Rice cropping system. A total of 90 species belongs to 38 families were recorded in the upper and lower Brahmaputra valley zone of Assam. A total of 7181 individuals of birds were recorded in Lakhimpur district followed by 3994 in Sivasagar. Only 94 individuals of birds were recorded in Kokrajhar district during the survey period. The species richness ranged from 15 to 89 in different districts and recorded highest in Sivasagar district with diversity index of 3.3 (Fig.2). 21 species of birds were found to be common in all the 9 districts (table.4) and recorded a higher mean abundance of Cattle Egret (27.41%) in all the districts followed by spotted dove (7.85%) and Asian pied sterling (7.62%). Highest abundance of Cattle egret (46.02%) was observed in Sivasagar district against Baya weaver (18.14%) in Lakhimpur district and Sand martin (38.83%) in Jorhat district. (Table 4).

Fig 1: Avian population(individuals)and similarity index in different districts of Assam



The avian diversity of 21 species that were common for the 9 districts showed a high abundance of cattle egret (46.02%) in Sivasagar district, Baya weaver (18.14%) in Lakhimpur district and Sand martin (38.83%) in Jorhat district (Table.4)

Fig.2: Species richness and Diversity Index in different districts of Assam

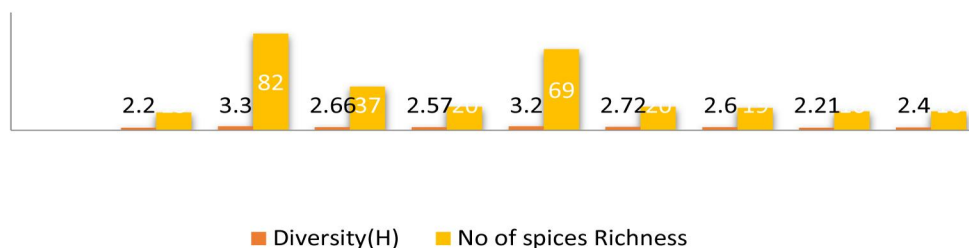


Table .3: Most abundant common Bird species observed at different districts of Assam

SI no	Birds Species	SCIENTIFIC NAME	FAMILY	ORDER
1	Asian pied starling	<i>Gracupica contra</i>	Sturnidae	Passeriforms
2	Black Drongo	<i>Dicrurus macrocercus</i>	Dicruridae	Passeriforms
3	Cattle Egret	<i>Bubulcus ibis</i>	Ardeidae	Pelecaniformers
4	Red watled Lapwing	<i>Venellus indicus</i>	Charadriidae	Charadriiformes
5	Jungle Myna	<i>Acridotheres Fuscus</i>	Sturnidae	Passeriforms
6	Dove	<i>Saurischia</i>	Columbidae	columbiformes
7	Kingfisher	<i>Saurischia</i>	Rafinesque	Coraciiformes
8	Barn swallow	<i>Hirundo rustica</i>	Harundinidae	Passeriforms
9	Baya Weaver	<i>Ploceus philippinus</i>	Ploceidae	Passeriforms
10	White breasted waterhen	<i>Amaurornis phoenicurus</i>	Rallidae	Gruiformes
11	Stone chat	<i>Saxicola rubicola</i>	Muscicapidae	Passeriforms
12	Indian Roller	<i>Coracias benghalensis</i>	Coraciidae	Coraciiformes
13	Small Bee eater	<i>Merops Orientalis</i>	Meropidae	Coraciiformes
14	Paddy field Pipit	<i>Anthus rufulus</i>	Motacillidae	Passeriforms
15	Indian pond Heron	<i>Ardeola grayii</i>	Ardeidae	Pelecaniformers
16	White Wagtail	<i>Motacill aalba</i>	Motacillidae	Passeriforms
17	House Sparrow	<i>Passer domesticus</i>	Passeridae	Passeriforms
18	Sand Martin	<i>Riparia riparia</i>	Hirundinidae	Passeriforms

Table 4.: Per cent abundance of common birds in agroecosystems of different districts

Sl no	Birds Species	District									% mean abundance
		Sivsa gar	Dhu bri	Lakhim pur	Kokra jhar	Jor hat	Chir ang	Maj uli	Bongaig aon	Dibru garh	total
1	Asian pied starling	11.56	8.25	8.05	7.93	0.64	9.19	3.36	14.06	5.57	7.62
2	Black Drongo	3.54	0.48	5.02	7.93	15.53	5.57	1.68	8.22	9.56	6.39
3	Cattle Egret	46.02	34.95	29.97	38.09	4.85	35.09	4.2	44.8	8.76	27.41
4	Red wattle Lapwing	1.77	7.76	2.41	3.17	0	7.24	1.68	0.21	1.99	2.91
5	Common Myna	1.717	7.28	2.72	4.76	1.29	1.39	8.4	0.64	4.78	3.66
6	Jungle Myna	2.23	0.97	10.59	4.76	3.23	13.37	0	1.29	5.97	4.71
7	Spotted Dove	2	7.28	5.07	0	3.88	0	40.33	2.16	9.96	7.85
8	Kingfisher	0.11	1.45	0.05	0	1.94	0.55	2.52	1.94	1.99	1.17
9	Barn swallow	0	0	9.07	0	3.23	0	0	0.43	9.96	2.52
10	Baya Weaver	15.28	0	18.14	0	3.23	0	0	6.49	5.97	5.45
11	White breasted water	0.62	11.16	0.23	0	0	0	1.68	1.082	2.39	1.90

	hen										
12	Common stone chart	1.03	1.94	0.18	6.34	3.23	8.35	0	9.95	1.19	3.57
13	Indian Roller	0.57	0	0	7.93	0	5.29	0	3.67	3.98	2.38
14	Small Bee eater	0.68	0.97	0	3.17	0	4.73	1.68	3.03	7.96	2.46
15	Paddy field Pipit	1.08	1.94	1.17	6.34	6.14	1.94	1.68	0.86	0.39	2.39
16	Indian pond Heron	0.22	9.7	7.16	3.17	0.64	7.24	4.2	0.64	5.57	4.28
17	White Wagtail	0.8	4.85	0	0	0	0	2.52	0.43	3.98	1.39
18	House Sparrow	3.03	0	0.05	0	8.73	0	5.04	0	3.98	2.31
19	Sand Martin	7.44	0	0.05	0	38.83	0	8.4	0	3.18	6.43
20	Grey Backed Shrike	0.11	0.97	0	6.34	3.23	0	12.6	0	1.19	2.71
21	Barbet	0.11	0	0	0	1.29	0	0	0	1.59	0.33

In the following year community structure of birds and their diversity in relation to crop stages in UBVZ and NBPZ was again conducted in different districts of Assam in

Rice/Rice cropping system. A total of 3028 individuals of birds were recorded in Lakhimpur district followed by 2229 in Sivasagar whereas 100 individuals of birds were recorded in Golaghat district during the survey period. (fig.3). The species richness ranged from 14 to 37 in different districts and recorded highest in Dibrugarh district with diversity index of 2.66 (Fig 4).18 species of birds were almost common in all the 6districts (table) and recorded a higher abundance of common Myna (22.22%) was observed in Majuli district followed by Bongaigoan district (21.82%) (Table 5).

Table 5. Per cent Abundance of common birds observed in different districts of Assam

Name of birds	Lakhimpur	Sivsagar	Dibrugarh	Bongaigoan	golaghat	Majuli
Asian pied starling	7.82	0.71	0.89	7.94	23.8	-
Black Drongo	7.13	0.31	0.53	2.47	4.76	1.58
Cattle Egreet	9.8	14.8	1.76	16.31	12.7	-
Red watled Lapwing	2.9	0.08	0.17	0.2	-	1.58
Common Myna	14.99	-	-	21.82	4.76	22.22
Jungle Myna	9.28	0.17	-	-	12.69	-
Spotted Dove	0.42	0.08	-	1.8	3.17	7.9
Kingfisher	1.32	-	0.89	0.7	0.79	-
Barn swallow	17.2	-	1.41	1.41	-	9.52
Baya Weaver	15.12	5.02	2.69	-	-	-
White brested waterhen	0.42	0.26	1.06	6.5	1.58	2.36
Common stone chart	2.33	-	0.53	2.8	0.79	-
Small Bee eater	4.62	-	3.53	0.8	-	-
Paddy field Pipit	2.14	-	0.17	0.26	-	-
Indian pond Heron	4.49	0.04	1.43	-	-	-
White Waigtail	0.41	0.08	-	2.13	-	4.76
House Sparrow	20.54	-	2.82	-	-	4.76
Grey Backed Shrike	2.51	-	1.41	1.8	0.79	-

Fig 3: Avian population(individuals)and similarity index in different districts of Assam

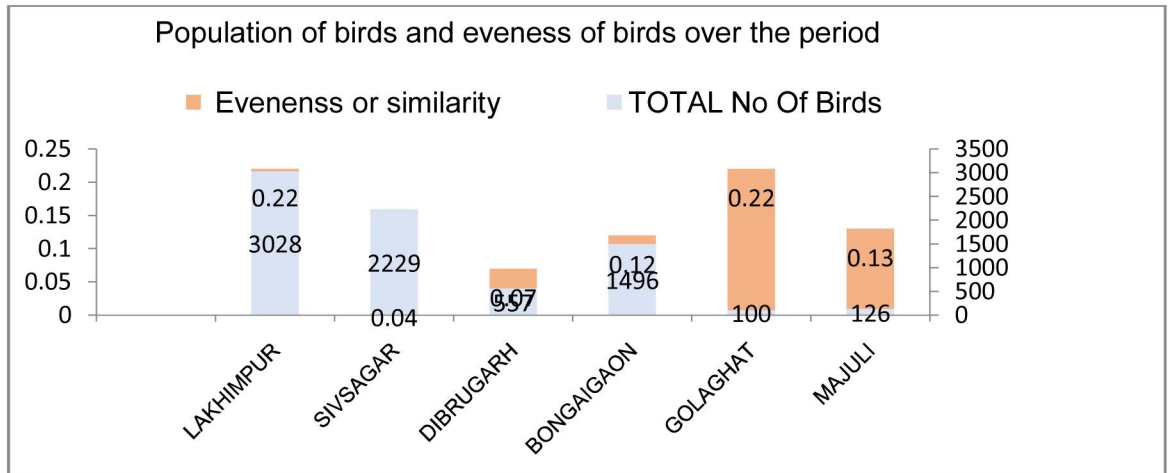
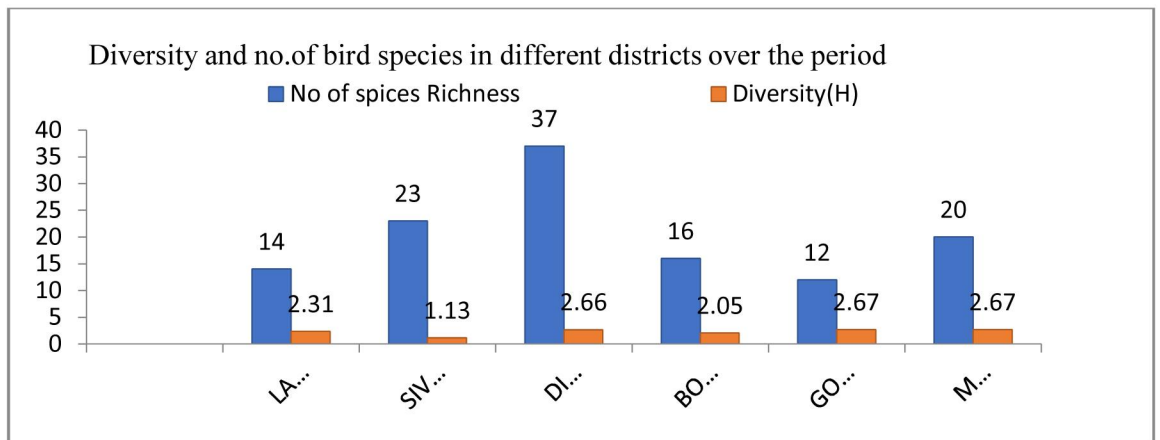


Fig.4. Species abundance in relation to diversity of birds in different districts



During the year 2019-20 effort was made to study relative abundance of birds in relation to crop stages: About 10, 17, 18 and 15 species of birds were recorded on transplanting, vegetative, maturity and harvesting stages. At transplanting stage, Barn swallow (41.91) was the highest followed by cattle egret (16.96) and common myna (14.97). At vegetative stage also the barn swallow (24.17) was the highest followed by Baya weaver (13.34) and common Myna (9.68). At maturity stage, the highest abundance was the Baya weaver (26.22) followed by the house sparrow (16.61) and spotted dove (9.68) while at harvesting stage it was observed that the house sparrow (20.54) outnumbered the baya weaver (18.87) followed by spotted dove (9.64).

Table 6: Relative abundance (%) of birds observed in paddy field in relation to different crop stages

Sl.No.	Bird Species	Transplanting stage	Vegetative stage	Maturity Stage	Harvesting stage
1	Cattle egret	16.96	11.63	1.02	1.26
2	Black drongo	1.39	3.84	3.54	2.09
3	Asian pied sterling	7.98	7.68	5.51	-
4	Dove	8.58	3.20	9.68	9.64
5	Common myna	14.97	11.82	7.00	9.01
6	Jungle myna	6.18	5.85	7.00	4.8
7	Barn swallow	41.91	24.17	5.04	-
8	Red wattle lapwig	0.39	3.62	4.65	5.87
9	Green bee eater	1.59	2.13	0.55	4.61
10	Paddy field pipit	-	1.17	0.55	-
11	Red vented bulbul	-	5.01	4.72	2.93
12	Baya weaver	-	13.34	26.22	18.87
13	Grey backed shrike	-	2.02	1.57	2.51
14	White breasted water hen	-	1.28	0.63	-
15	White wagtail	-	1.70	0.47	-
16	Rufous treepie	-	0.53	-	-
17	Jacana	-	-	-	1.68
18	Asian open bill	0.85	0.85	-	-
19	Munia	-	-	2.52	3.14
20	House sparrow	-	-	16.61	20.54
21	Stone chat	-	-	2.68	4.82

During 2021-22 Studies were conducted on Community structure of birds and their diversity in relation to crop stages in UBVZ and NBPZ Assam in Rice/Rice cropping system. A total of (9887) individuals of birds were recorded in Bongaigaon district followed by

Lakhimpur district (3732) district during the survey period. (fig.5). The species richness ranged from 12 to 15 in different districts and recorded highest in Lakhimpur district with diversity index of 2.4 (Fig 6).Jungle Myna (37.04%) was observed to be the highly abundant bird species in Golaghat district followed by cattle egret (16.2) in Lakhimpur district. (Table 7).

Table 7. (%) Abundance of some common birds observed in different districts of Assam

SL.No.	Bird species	Lakhimpur	Bongaigoan	Golaghat	Majuli	Total
1	Asian pied starling	7.51	6.95	23.8		38.26
2	Black Drongo	7.26	0.03	4.76	1.58	13.63
3	Cattle Egreet	16.2		8.16	7.3	43.17
4	Red watled Lapwing	2.9	0.2		1.58	4.68
5	Common Myna	15.3	16.2	3.9	24	59.4
6	Jungle Myna	6.69	6.42	37.04		50.15
7	Spotted Dove	4.82	16.2	1.92	9.4	32.34
8	Barn swallow	11.8	1.41	11.2	5.1	29.51
9	Baya Weaver	21.7			15	36.7
10	White brested waterhen	0.46	0.18	1.9	1.6	4.14
11	Munia	7.86	2.8	0.79		11.45
12	White Waightail	0.22	0.36	5.66	4.2	10.44
13	House Sparrow	4.94	11.5	1.85	2.5	20.79

Fig 5: Avian population (individuals)and similarity index in different districts of Assam

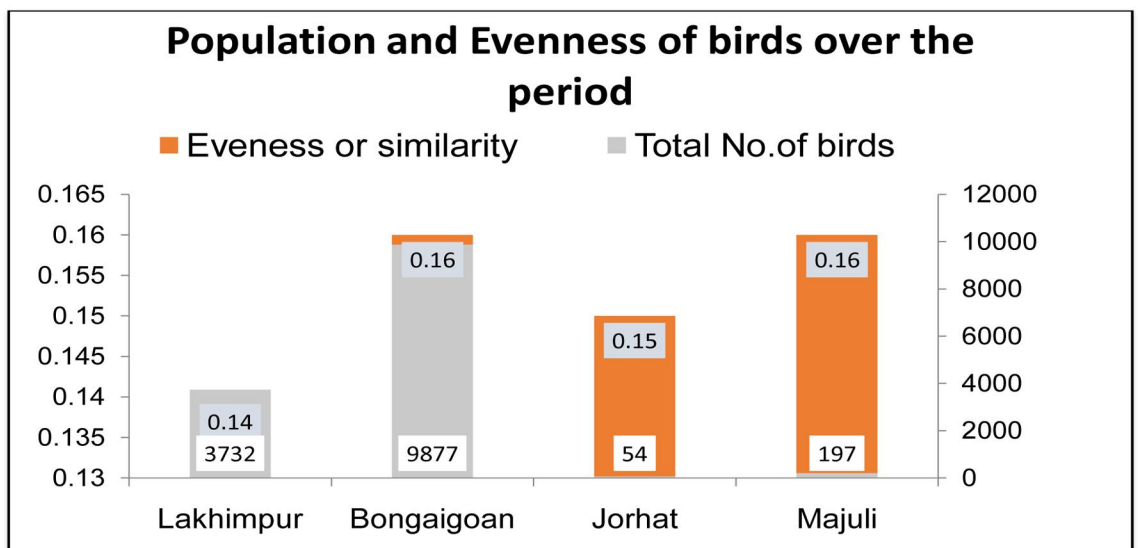
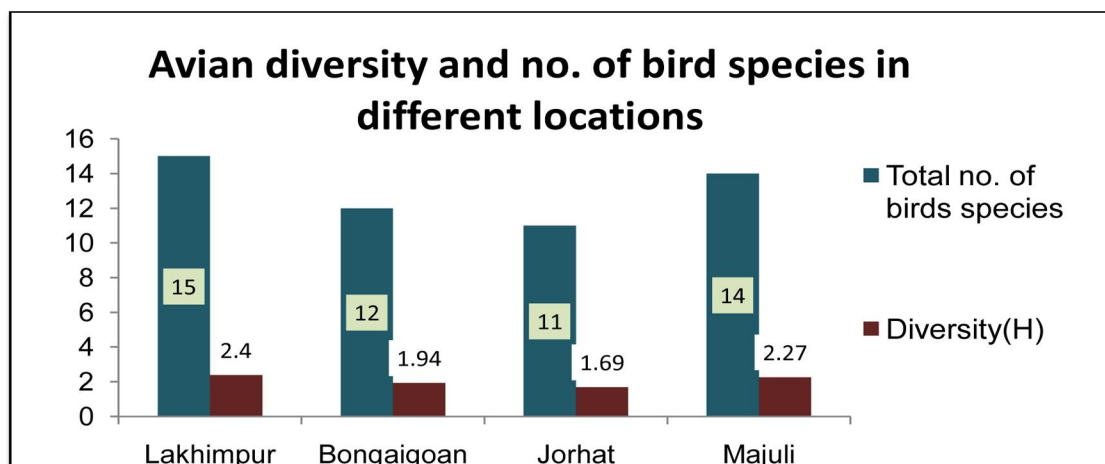


Fig 6. Species abundance in relation to diversity of birds in different districts.



Community structure of predatory and depredatory birds in Summer rice :

Results: About 9,17,18 and 14 species of birds were recorded on transplanting, vegetative, maturity and harvesting stages. Abundance of the predatory birds were found to be more than the beneficial birds in Summer rice during the period. Cattle egret (13.57%) followed by Common myna (11.98%) showed the highest relative abundance in the transplanting stage of the crop. In maximum tillering and vegetative stage, Barn swallow was observed to be highly abundant with (23.29%) followed by Baya weaver (12.93). In reproductive stage, Baya weaver (36.81%) was observed to be the highest followed by Munia (14.88%). And in harvesting stage, Munia was the dominant species with 19.75% abundance. (table 8)

Table 8: Relative abundance (%) of birds observed in paddy field in relation to different crop stages

Sl.No.	Bird Species	Transplanting stage	Vegetative stage	Maturity Stage	Harvesting stage
1	Cattle egret	13.57	11.63	1.02	1.26
2	Black drongo	1.39	3.84	3.54	2.09
3	Asian pied sterling	7.98	7.68	5.51	-
4	Dove	8.58	3.2	9.68	9.64
5	Common myna	11.98	11.82	7	9.01
6	Jungle myna	6.18	5.85	7	4.8
7	Barn swallow		23.29	5.04	-
8	Red wattle lapwig	0.39	3.62	4.65	5.87

9	Green bee eater	1.59	2.13	0.55	4.61
10	Paddy field pipit	-	1.17	0.55	
11	Red vented bulbul	-	5.01	4.72	2.93
12	Baya weaver	-	12.93	36.81	18.87
13	Grey backed shrike	-	2.02	1.57	2.51
14	White breasted water hen	-	1.28	0.63	-
15	White wagtail	-	1.7	0.47	-
16	Jacana	-	-	-	1.68
17	Asian open bill	0.85	0.85	-	-
18	House sparrow	-	-	2.52	3.14
19	Munia	-	-	14.88	19.75
20	Stone chat			2.68	4.82

During 2021-22 surveillance of birds following line transect method was carried out, the report reveals Cattle egret to be the most abundant species. 6478 No. of individual birds was observed with 0.13 evenness among the birds. Species richness was 14 with 1.8 diversity index. Species richness in paddy-paddy cropping system was observed to be 63 with diversity 1.54 and in paddy-maize cropping system, it was observed to be 28 species with 1.21 diversity. Insectivorous birds were the highly occurred bird while observing the foraging guild in both paddy and maize crop ecosystem.

Table 9: Relative abundance (%) of important bird species in rice field of Lakhimpur district during *Kharif* season 2021

Sl. No.	Bird species	% abundance *
1	Asian pied starling	0.04
2	Black Drongo	2.18
3	Cattle Egret	38.1
4	Red wattled Lapwing	2.9
5	Common Myna	19.59
6	Jungle Myna	16.22
7	Spotted Dove	2.92
8	Barn swallow	11.8
9	Baya Weaver	8.01

10	White breasted waterhen	0.46
11	Munia	7.86
12	White Waihtail	0.22
13	House Sparrow	4.94
14	Indian pond heron	11.9

Total No. of Birds (N)	6478
Evenness	0.13
Total no. of bird species	14
Diversity(H)	1.8

Cropping system	Shannon H	Species richness
Paddy – paddy	1.54	63
Paddy-Maize	1.21	28

Table 10: Per cent occurrence of birds and their foraging guild in relation to crops

Foraging Guild	Paddy	%	Maize	%
Frugivorous	02	03	01	04
Granivorous	12	18	04	14
Insectivorous	28	42	14	50
Nectarivorous	01	01	01	04
Omnivorous	18	27	06	21
Carnivorous	06	09	02	07
Total	67	100	28	100

Identification of communal roosting sites of depredatory birds & mix roosts

GPS based Survey on roosting sites on depredatory birds in North Bank Plain Zone of Assam recorded 3 large mix roost, 2 large communal roost and one communal roost. The feeding activity ranges with an average of 10.75 sq km. The extent of damage on different crops varied in relation to the availability of roost & no. of birds. The incident of damage was very high within 7.5 sq km range from the roost.



Habitat analysis and distribution of Depredatory Weaver Birds in Assam.

Extensive survey and surveillance was done from June 2021 to April 2022 covering 39 villages of Lakhimpur and Sivasagar district of Assam. During the survey three species of weaver birds in agro ecosystems of the abovementioned districts was recorded and identified as Streaked weaver *Ploceus manyar*, Black-breasted weaver *P. benghalensis* and Baya weaver *P. philippinus*.

Baya weaver colony was found to be relatively abundant than two other recorded species with 84.2% abundance followed by Streaked weaver (11.18%) and Black-breasted weaver (4.61%). The colony of Baya weaver was found to be large with maximum of 22 (4- 47 per colony) nests recorded in a single Areca nut tree in a homestead of Sivasagar district against maximum 7 nests (3- 7 nest/colony) in Streaked weaver in a cane groove nearer to water body and least in case of Black breasted weaver with only 4 nests (2 -4 nests per colony) in a reed groove near low land paddy field.

Table 11. Habitat analysis of Weaver birds in Assam

Tree species utilized for nesting	Nest numbers recorded in bird colony	Weaver Species	bird	Per cent abundance
Arecanut, Date palm, coconut, Tokow	128	Baya weaver		84.21
Kahuwa, Khagori, Birina (Reeds), Bamboo, Sugarcane, Cane, Napier, Dhaincha, Banana, Ver	17	Streaked weaver		11.18
Assam lemon, reeds, cane	7	Black breasted weaver		4.61

Breeding season starts from April and end in the month of September. Nesting, egg laying found in April May while rearing of juvenile observed during July – August. Lays 2 -4 eggs per nest. Migrated to the paddy field during mid-September. Roosting was observed on reeds, Alpinia, Dhaincha and other medium height trees near to paddy fields.

Habitat analysis and distribution of birds during 2022-23 reveals highest number of bird individuals recorded in the month of November followed by August. Diversity index varies between 1.6 to 2.8 and birds are found to be evenly distributed in all the district except Goalpara. 125 Bird spp recoded during the survey period April 2022 to January 2023. Barn swallow was observed to be the most abundant species followed by cattle Egret and Common Myna .2226 No. of individual birds was observed in survey locations of 10 districts. Highest 25 bird species recorded in Goalpara district followed by Lakhimpur (24)and Biswanath (20).

Diversity Indices of Birds in different districts of Assam during 2022-23

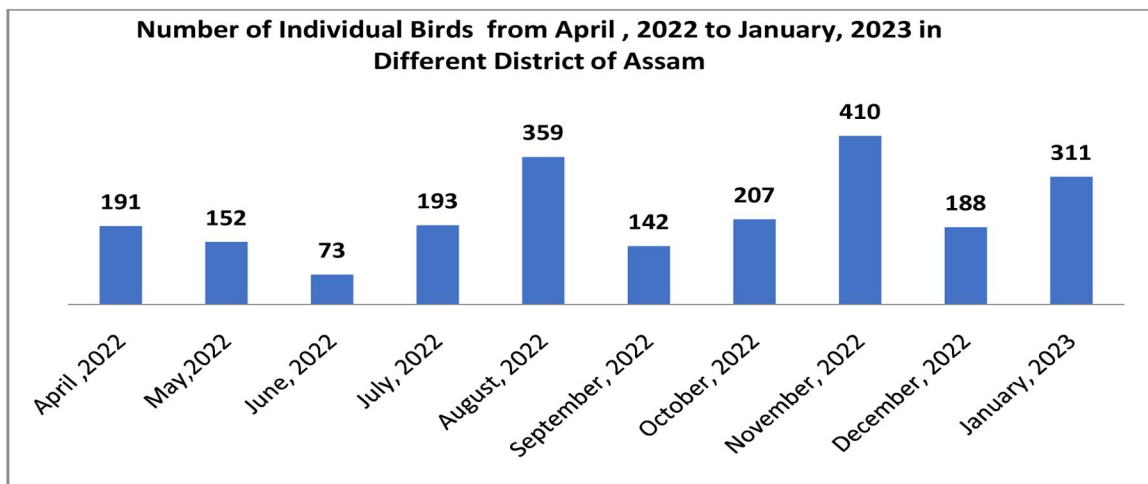


Fig & Map 1: Bird population & GPS location in different districts of Assam

Link : <https://goo.gl/maps/SaxvN1hH6LKqycik9>

Table 12: Relative abundance (%) of important bird species in rice field of different district of Assam during *Rabi* season 2022-23

Sl. No.	Birds Species	% Abundance in different districts									
		Guwahati	Morigaon	Goalpara	Nalbari	Biswanath	Lakhimpur	Dhemaji	Sivasagar	Dibrugarh	Tinsukia
1	Lesser whistling Duck	0.00	10.61	0.00	15.79	13.16	6.20	0.00	0.00	3.33	6.45
2	Spotted Dove	8.00	7.58	3.32	2.63	13.16	11.24	11.20	4.08	0.00	3.23
3	Red Wattle lapwig	0.00	3.03	3.79	10.53	0.88	7.75	1.60	5.10	3.33	6.45
4	Asian Openbill	12.00	7.58	0.47	2.63	3.95	2.33	3.20	0.00	0.00	0.00
5	Little Cormorant	12.00	0.00	0.95	6.58	0.00	4.26	4.00	0.00	0.00	0.00
6	Cattle Egret	0.00	10.61	0.00	3.95	6.14	6.20	6.40	32.14	30.00	19.35
7	Pond Heron	0.00	1.52	4.74	0.00	0.88	3.49	10.40	9.69	0.00	6.45
8	Kingfisher	0.00	0.00	2.37	2.63	2.63	1.55	4.00	1.02	20.00	0.00
9	House Sparrow	0.00	0.00	0.00	0.00	2.19	0.00	0.00	0.00	0.00	0.00
10	Black Drongo	4.00	0.00	0.47	11.84	3.07	4.65	11.20	8.16	0.00	0.00
11	Common Myna	12.00	1.52	7.39	10.53	11.40	9.30	17.60	5.10	23.33	22.58
12	Baya weaver	0.00	4.55	0.00	0.00	0.88	5.81	0.00	1.02	0.00	0.00
13	Barn swallow	0.00	9.09	37.91	0.00	19.74	5.84	0.00	0.00	0.00	0.00
14	Grey backed shrike	4.00	1.52	3.79	0.00	0.00	0.77	0.00	32.14	0.00	0.00
15	Red vented bulbul	0.00	3.03	0.95	0.00	3.07	3.87	11.20	10.20	0.00	0.00
16	White Wagtail	0.00	4.55	9.00	0.00	0.00	4.26	1.60	5.10	0.00	0.00
17	Tree sparrow	8.00	3.03	0.00	0.00	0.00	3.10	0.00	0.00	0.00	0.00
18	Stonechat	0.00	0.00	1.90	0.00	0.00	2.71	0.00	1.02	0.00	0.00
19	Starling	0.00	7.58	13.74	0.00	2.63	5.42	15.20	10.20	3.33	0.00
20	Green Bee Eater	0.00	3.03	0.95	0.00	2.19	1.16	0.80	1.53	0.00	0.00
21	Koel	8.00	0.00	0.47	10.53	2.19	0.00	0.00	5.10	0.00	9.68
22	Pigeon	16.00	0.00	1.90	11.84	6.58	0.00	0.00	9.18	0.00	0.00
23	Crow	8.00	3.03	0.95	5.26	0.44	0.39	0.00	0.00	16.67	0.00
24	Rose ringed Parakeet	4.00	3.03	0.47	0.00	0.88	0.00	0.00	0.00	0.00	16.13
25	Tailor bird	4.00	0.00	0.47	5.26	3.95	0.00	1.60	0.00	0.00	9.68
26	Warbler	0.00	4.55	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00
27	Magpie Robin	0.00	3.03	0.95	0.00	0.00	0.00	0.0	0.00	0.00	0.00
28	Barbeet	0.00	7.58	0.47	0.00	0.00	0.00	0.0	8.16	0.00	0.00
29	Munia	0.00	0.00	3.32	0.00	0.00	0.00	0.0	0.00	0.00	0.00
30	Adjustant Stork	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.59	0.00	0.00
	Species richness	12.00	20.00	25.00	13.00	20.00	24.00	14.00	15.00	7.00	9.00
	Shanon H	2.30	2.80	2.30	2.40	2.50	2.80	2.30	2.00	1.60	2.00
	Eveness	0.19	0.14	0.09	0.18	0.12	0.11	0.16	0.13	0.20	0.20

Map 2. GIS based Survey points in different districts of Assam

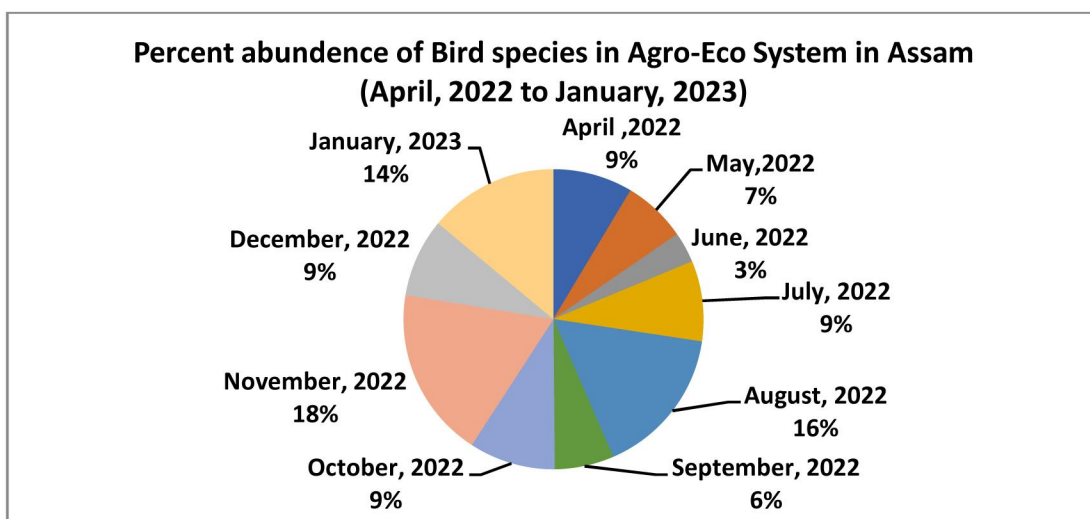
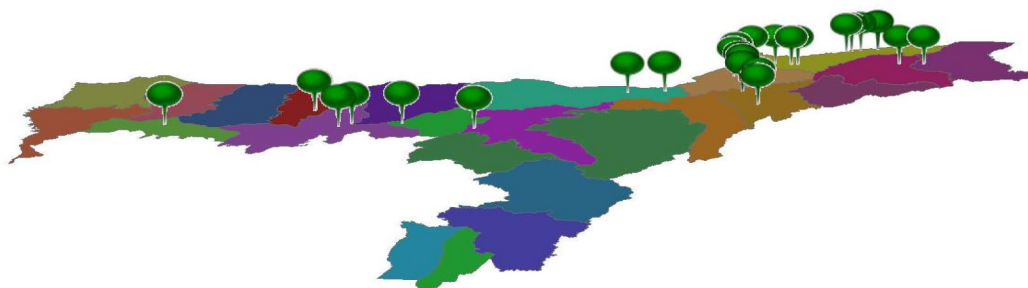


Fig 7. Per cent Bird abundance during the survey periods (April 22 to January 2023)

Table 13. Diversity Index of bird population in Homestead garden in Sivasagar district

Individual (No.)	Species Richness (<i>Menhinick Index</i>)	Species Density	Shannon Weiner Index (H)	Evenness (J)
497	41(D= 1.38)	4.42	2.44	0.712789

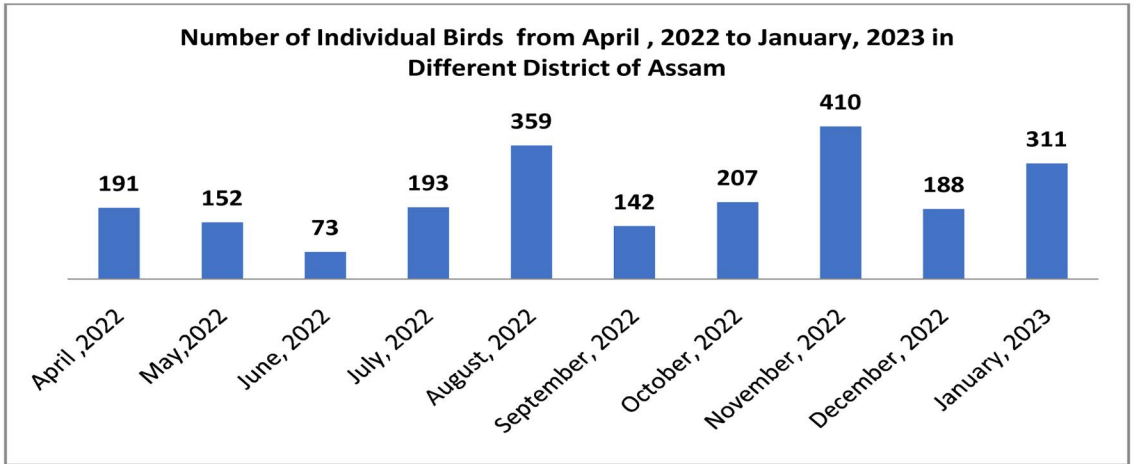
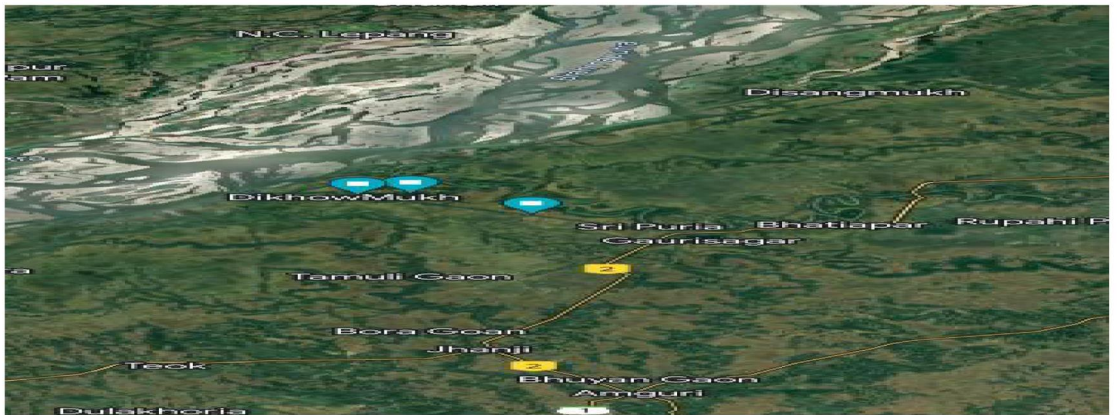


Fig 8. Bird population fluctuation in different months in different districts



Map 3: GPS location of bird survey in homestead gardens in Sivasagar district

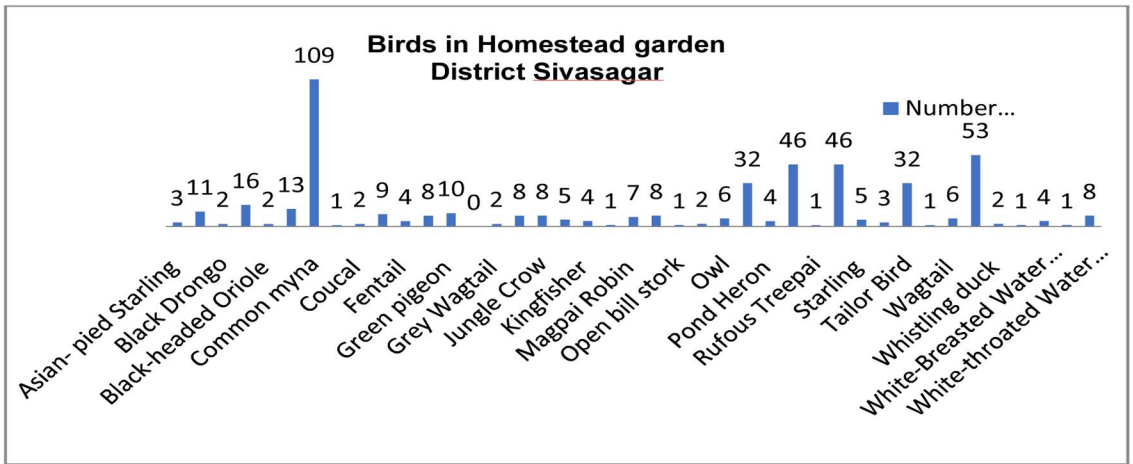
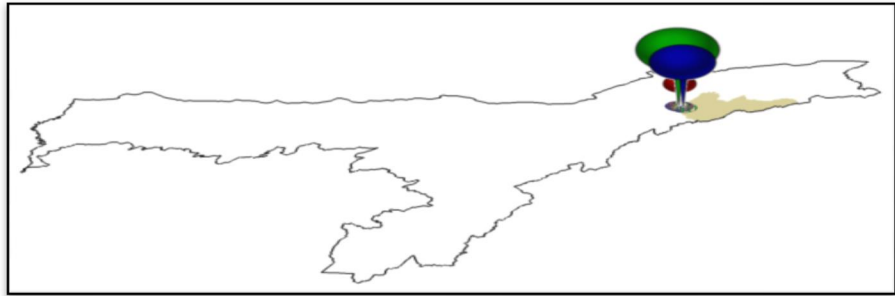


Fig 9. Bird species in homestead garden recorded at Sivasagar district



Map 4. GPS locations of the surveyed villages in Sivasagar district

Habitat Analysis and distribution of Birds in agro ecosystem of Assam during 2023-24: 25 locations of Nine districts distributed in 4 Agro- climatic zones of Assam viz., Lower Brahmaputra, central, North Bank Plain and upper Brahmaputra valley zone has been covered during the year for habitat analysis and distribution study following transect and point count methods in agricultural landscape of Assam in Homestead, Paddy- Mustard and paddy- fallow cropping system during August 2023 to February 2024 (Table 14 Map 5). A total of 185 species of birds recorded during the seven month extensive survey presented in the draft checklist (Table 14) where highest beneficial omnivorous individual was found to be Common Myna (185) followed by Asian pied starling (172) and Cattle Egret (111) against depredatory birds Spotted Dove (142) and Rose Ringed Parakeet (79) . A total of 2717 individual Bird population found to be abundant in February in *Rabi* season followed by November against higher abundance in the month of September followed by August during *Kharif* crop season. Barpeta district recorded highest Shannon index of 3.28 with 37 bird species followed by Lakhimpur with 2.8 Diversity index for 26 species (Table 15).

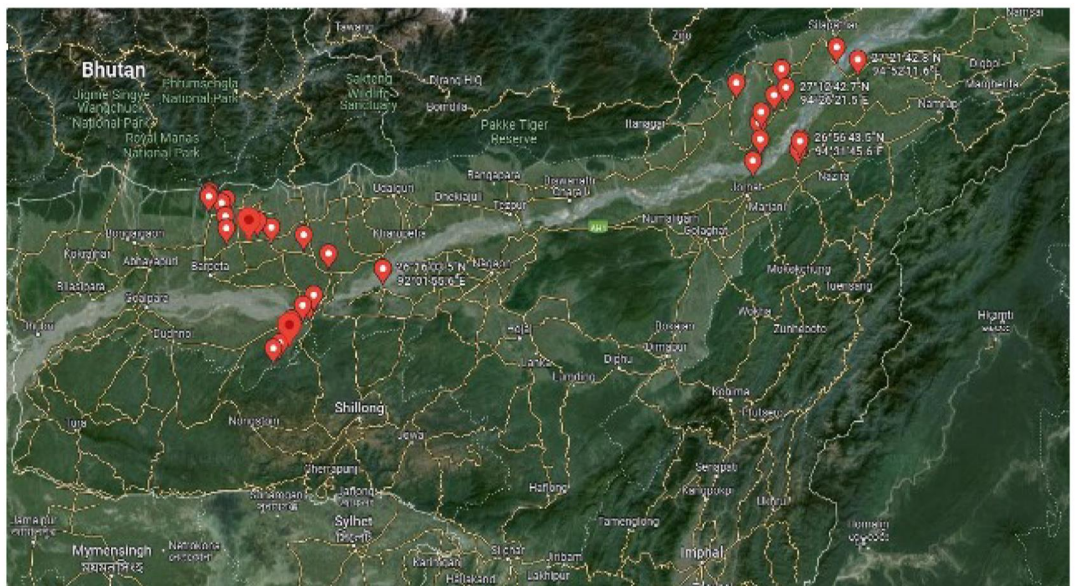
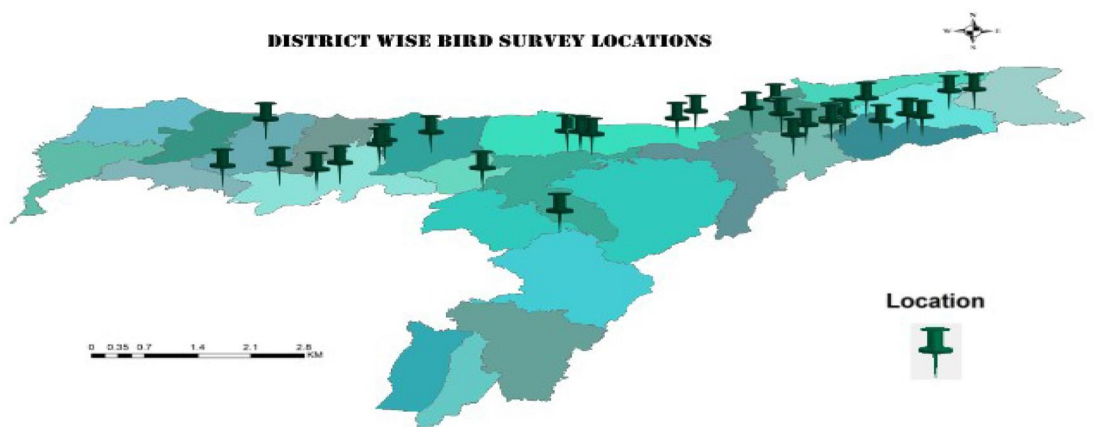
Table 14. Bird checklist of agro ecosystem in agro-climatic zones of Assam

Spp No.	Bird Name	Individual	Spp No.	Bird Name	Individual
1	Abbott's Babbler	8	44	Cinereous Tit	33
2	Aberrant Bush Warbler	3	45	Cinnamon Bittern	4
3	Adjutant stork	3	46	Common Kingfisher	6
4	Alexandrine Parakeet	5	47	Common Myna	185
5	Ashy Drongo	1	48	Common Sandpiper	5
6	Ashy Woodswallow	3	49	Common stonchat	4
7	Asian Barred Owlet	3	50	Common Tailorbird	28
8	Asian Emerald Dove	1	51	Coppersmith Barbet	2
9	Asian Fairy-bluebird	3	52	Crow-billed Drongo	1
10	Asian Green Bee-eater	30	53	Dark-necked Tailorbird	1
11	Asian Koel	3	54	Daurian Redstart	3

12	Asian Openbill	25	55	Dusky Warbler	13
13	Asian Palm Swift	40	56	Eastern Cattle Egret	39
14	Asian pied Starling	129	57	Eurasian Collared-Dove	1
15	Asian Woolly-necked Stork	2	58	Eurasian Coot	5
16	Assian Pied Starling	0	59	Eurasian Hoopoe	1
17	Barn Swallow	171	60	Eurasian Tree Sparrow	11
18	Baya Weaver	55	61	Eurasian Wryneck	1
19	Bee eater	6	62	Fulvous-breasted Woodpecker	6
20	Bengal Bushlark	6	63	Gadwall	2
21	Black Breasted weaver	1	64	Glossy Ibis	7
22	Black Drongo	76	65	Golden-fronted Leafbird	3
23	black headed munia	20	66	Gray Heron	1
24	Black Kite	5	67	Gray-backed Shrike	5
25	Black Winged Kite	2	68	Gray-bellied Tesia	1
26	Black-crested Bulbul	6	69	Gray-headed Canary-Flycatcher	13
27	Black-crowned Night-Heron	1	70	Gray-headed Swamphen	1
28	Black-faced Bunting	5	71	Gray-headed Woodpecker	2
29	Black-hooded Oriole	17	72	Graylag Goose	21
30	Black-naped Monarch	4	73	Gray-sided Bush Warbler	2
31	Black-rumpedFlameback	3	74	Gray-throated Babbler	1
32	Blue Whistling-Thrush	1	75	Great Barbet	4
33	Blue-eared Barbet	2	76	Great Cormorant	3
34	Blue-throated Barbet	9	77	Great Egret	5
35	Blyth's Reed Warbler	4	78	Great Myna	8
36	Bronze-winged Jacana	9	79	Great Tit	5
37	Brown Shrike	8	80	Greater Adjutant	1
38	Cattle Egret	111	81	Greater Adjutant stork	1
39	Chestnut Munia	14	82	Greater Flameback	1
40	Chestnut-crowned Bush Warbler	2	83	Greater Painted-Snipe	4
41	Chestnut-eared Bunting	1	84	Greater Racket-tailed Drongo	3
42	Chestnut-headed Bee-eater	1	85	Greater Yellownape	4
43	Chestnut-tailed Starling	21	86	Green Imperial-Pigeon	5

87	Green-billed Malkoha	2	133	pady field pipit	6
88	Green-crowned Warbler	1	134	Pheasant-tailed Jacana	4
89	Greenish Warbler	3	135	Pied Harrier	1
90	Hair-crested Drongo	6	136	Pied Kingfisher	3
91	Hoopoo	1	137	Pond Heron	9
92	House Crow	6	138	Purple Heron	1
93	House Sparrow	33	139	purple swampphen	12
94	Hume's Warbler	1	140	Pygmy Cupwing	1
95	Indian Pied Starling	90	141	Red Collared-Dove	9
96	Indian Pond-Heron	40	142	Red vented Bulbul	64
97	Indian roller	2	143	Red-breasted Parakeet	11
98	Indian Spot-billed Duck	8	144	Red-crested Poachard	10
99	Indian White-eye	41	145	Red-vented Bulbul	56
100	Indochinese Roller	5	146	Red-wattled Lapwing	43
101	Intermediate Egret	19	147	Red-whiskered Bulbul	20
102	Jungle Babbler	5	148	Rose-Ring Parakeet	79
103	Jungle Myna	83	149	Ruby-cheeked Sunbird	2
104	kingfisher	5	150	Ruddy Shelduck	8
105	Lapwing	21	151	Rufous Treepie	16
106	Large Cuckooshrike	1	152	Sand Lark	2
107	Large-billed Crow	30	153	Scaly-breasted Munia	30
108	Lesser Adjutant	17	154	Scarlet Minivet	4
109	Lesser adjutant stork	7	155	Scarlet-backed Flowerpecker	2
110	Lesser Racket-tailed Drongo	3	156	Shikra	1
111	Lesser Shortwing	1	157	Siberian Stonechat	15
112	Lesser Whistling-Duck	89	158	Small Niltava	1
113	Lineated Barbet	9	159	Smoky Warbler	1
114	Little Bunting	3	160	Spotted Bush Warbler	2
115	Little Cormorant	44	161	Spotted Dove	142
116	Little Egret	22	162	Spotted Owlet	1
117	Little Grebe	5	163	Stork-billed Kingfisher	1
118	Little Ringed Plover	4	164	Striated Grassbird	2
119	Little Spider hunter	1	165	Striated Heron	1
120	Long tailed shrike	3	166	Swamp Francolin	2
121	Long-legged Buzzard	1	167	Taiga Flycatcher	10
122	Long-Tail Shrike	2	168	Tailor Bird	3
123	Medium Egret	4	169	Tickell's Leaf Warbler	3
124	open bill stork	2	170	vulture	10
125	Oriental Darter	2	171	Watercock	2
126	Oriental Magpie-Robin	20	172	Whiskered Tern	1
127	oriental pied hornbll	2	173	Whistler's Warbler	5

128	Oriental Skylark	3	174	white breasted Water hen	9
129	Oriental Turtle-Dove	1	175	White Wagtail	28
130	Osprey	1	176	White-breasted Waterhen	17
131	Paddyfield Pipit	3	177	White-browed Piculet	2
132	Paddyfield Warbler	2	178	White-rumped Munia	16
179	White-throated Bulbul	4	182	Yellow Bittern	2
180	White-throated Fantail	6	183	Yellow-browed Warbler	11
181	White-throated Kingfisher	25	184	Yellow-footed Green-Pigeon	74
			185	Zitting Cisticola	1
Total (Individual Birds)No. 2717					



Map 5. Survey locations in Lower, Central and upper Brahmaputra valley zones of Assam

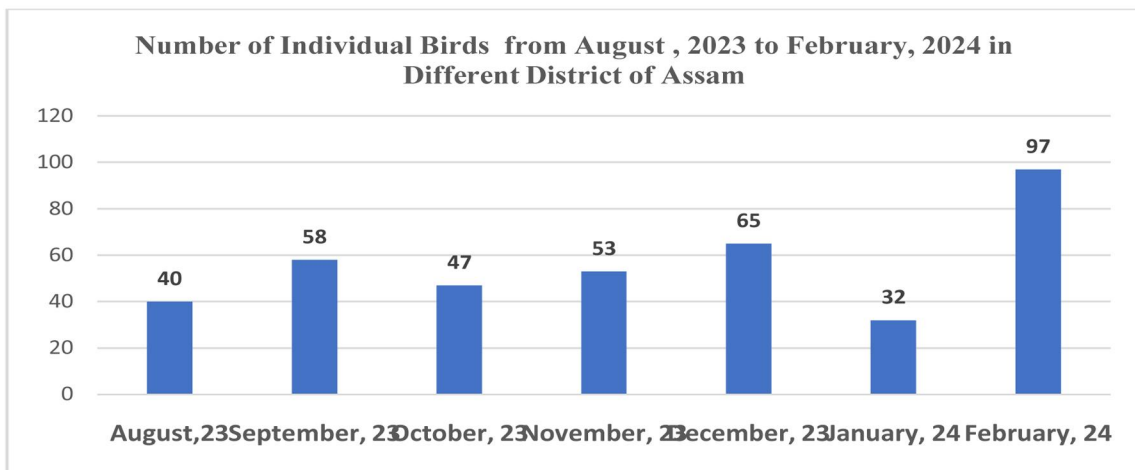
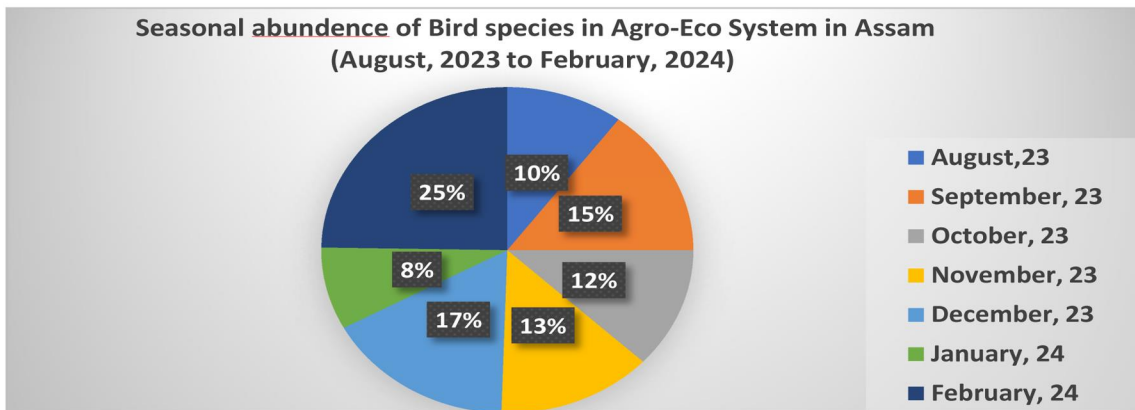


Fig. 9&10. Spatial distribution of birds in agro climatic zones of Assam

Table 15. Population estimation and spatial distribution of birds in Agricultural landscape in Agro climatic zones of Assam 2023-24

Indices	Darrag	Nagaon	Charaido	Borpeta	Sonitpur	Lakhimpur	Sivasagar
Species richness	15	17	9	37	23	26	15
Shannon H	2.48	2.59	2.04	3.12	2.8	2.8	1.3
Evenness	0.16	0.14	0.2	0.08	0.12	0.1	0.09

Avian diversity AAU-ZRS, North Lakhimpur

A total of 2465 number of bird individuals were observed at AAU-ZRS, North Lakhimpur during the year 2024-25. Highest number of total individual birds was recorded in the month of October followed by June. The surveillance revealed 19 species of predatory birds against only 6 species of depredataory bird species in different Agro-Ecosystem at AAU-ZRS, North Lakhimpur campus. Barn Swallow was noticed to be most abundant while species richness was observed to be highest in the month of November and December.

Table 16. No. of Bird Population in Rice-Rice, Rice-Mustard, Rice-Maize ecosystem of AAU-ZRS,

Bird Species	No. of Bird Species from August, 2024 to June 2025											Total	% Abundance
	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June		
Red-wattled lapwing	4	12	21	8	8	0	0	0	0	7	15	75.0	3.04
Cattle egret	35	50	20	20	38	28	17	23	15	6	70	322	13.06
Indian pond heron	8	8	0	0	0	0	0	0	0	9	9	34.0	1.37
Common Myna	17	27	3	4	20	8	18	6	3	23	3	132	5.35
Burn swallow	57	8	6	36	13	44	100	0	0	150	130	544	22.06
Black drongo	7	6	16	5	21	17	1	0	0	1	1	75.0	3.04
Asian open billed	0	9	0	0	0	0	0	0	0	0	9	18.0	0.73
Paddy field pippet	0	2	1	4	2	2	0	0	0	0	0	11.0	0.44
Jungle myna	0	2	6	12	8	4	10	3	0	9	7	61.0	2.47
White breasted waterhen	0	0	1	3	0	0	0	0	0	3	8	15.0	0.60
Shrike	0	0	1	2	2	0	0	0	0	0	0	5.00	0.20
Stonechat	0	0	3	4	1	8	3	0	0	0	0	19.0	0.77
White wagtail	0	0	1	2	0	0	0	0	0	0	0	3.00	0.12
Kingfisher	0	0	0	2	3	2	2	1	0	2	2	14.0	0.56
Great tit	0	0	0	0	1	3	1	0	0	0	0	5.00	0.20
Hoopoe	0	0	0	0	1	0	0	0	0	0	0	1.00	0.04
Oriental magpie robin	0	0	0	0	0	6	4	0	4	0	0	14.0	0.56
Lesser adjutant stork	0	0	0	0	0	0	3	0	0	4	6	13.0	0.52
Pied Starling	6	4	5	2	2	4	0	1	2	5	4	35.0	1.41
Spotted dove	11	22	11	8	23	27	32	17	10	5	16	182	7.38
Rose Ringed parakeet	4	3	14	4	1	0	2	2	13	0	0	43.0	1.74
Red vented Bulbul	2	1	0	0	0	0	0	0	0	4	7	14.0	0.56
Scaly breasted Munia	11	0	121	23	57	9	43	21	11	27	25	348	14.11
Baya weaver	4	12	172	12	110	11	6	0	0	8	21	356	14.44

Eurasian Tree Sparrow	16	0	18	12	14	0	5	9	18	9	25	126	5.11
Total	182	166	415	163	325	173	247	83	76	272	358	2465	
Total												2465	

Table- 17: Diversity index of bird population in rice-rice, rice-mustard, rice-maize ecosystem of AAU-ZRS, NL

Individual (No.)	Species Richness (<i>Menhinick Index</i>)	Shannon Weiner Index (H _c)	Evenness (J)
2465	25	2.4314069	0.755359055

A survey was carried on 13 districts of Assam covering three Agro-climatic zones viz., North Bank Plain Zone, Upper Brahmaputra Valley Zone & Central Brahmaputra Valley Zone. Total 4099 bird individuals were recorded with highest species richness observed in Jorhat followed by Darrang district and total number of individual bird species was recorded to be highest in Darrang district. Jorhat district recorded highest Shannon index of 3.73 followed by Nagaon district.(3.61).

New addition in the checklist of birds in agricultural landscape of Assam

- Indian Peafowl in Narayanguri in Baksa district near Manas National Park,
- Swamp francolin in Baksa , Biswanath & Golaghat, Bengal Florican & Blue – breasted Quail in Baksa

Table-18: Diversity indices of birds in different districts of assam during 2024-25

Diversity indices	Jorhat	Sivasagar	Charaideo	Golaghat	Nagaon	Morigaon	Darrang	Biswanath	Sonitpur	Majuli	Tinsukia	Udalguri	Dhemaji
Species Richness	69.0	44.0	26.0	32.0	54.0	33.0	57.0	45.0	23.0	40.0	29.0	25.0	54.0
Shannon H	3.73	2.90	2.10	3.01	3.61	1.75	2.80	2.40	2.57	2.86	2.64	2.85	3.26
Evenness	0.88	0.76	0.64	0.86	0.90	0.50	0.69	0.63	0.81	0.77	0.78	0.88	0.81

PURPLE MOORHEN: DISTRIBUTION OF PURPLE MOORHEN IN ASSAM

A total of 187 number of adult purple moorhen individuals were observed in different locations of Sivasagar, Majuli, Lakhimpur, Dhemaji and Jorhat districts of Assam, covering North Bank plain zone and Upper Brahmaputra valleyzone of Assam from July to September, 2025 in *Bao* paddy fields and were found damaging the crop during early morning and late evening, mostly the vegetative stage of the crop. An average transect walk of 360.86m was done and an average 8.91% of damage was observed.

Table .19.Distribution of purple moorhen in assam

Sl no	District	No. adults observed	Agri-field type	Crops	Crops growth stage	Survey area	Transect length	Damage time	Damage percent
1	Sivasagar	8	Deep agri-field	Bao rice	Vegetative	N-26.96873°/E-94.4469°	300 mt	Early morning, late evening	5%
2	Sivasagar	12	Deep agri-field	Bao rice	Vegetative	N-26.953763°/E-94.577162°	500mt	Early morning, late evening	10%
3	Sivasagar	10	Deep agri-field	Bao rice	Vegetative	N-26.956158°/E-94.603278°	300mt	Early morning, late evening	5%
4	Sivasagar	5	Deep agri-field	Bao rice	Vegetative	N-26.969355°/E-94.515°	250mt	Early morning, late evening	5%
5	Sivasagar	10	Deep agri-field	Bao rice	Vegetative	N-26.998064°/E-94.484972°	500mt.	Early morning, late evening	15%
6	Sivasagar	4	Deep agri-field	Bao rice	Vegetative	N-27.022703°/E-94.039721°	200 mt	Early morning, late evening	5%

7	Sivasagar	8	Deep agri-field	Bao rice	Vegetative	N-27.05371 7°E-94.57951 5°	500mt	Early morning, late evening	10%
8	Sivasagar	10	Deep agri-field	Bao rice	Vegetative	N-27.06018 6°E-94.57659 5°	300mt	Early morning, late evening	5%
9	Sivasagar	5	Deep agri-field	Bao rice	Vegetative	N-27.06187 6°E-94.57589 4°	250mt	Early morning, late evening	5%
10	Sivasagar	7	Deep agri-field	Bao rice	Vegetative	N-27.02327 2°E-94.50956 1°	500mt	Early morning, late evening	15%
11	Sivasagar	8	Deep agri-field	Bao rice	Vegetative	N-26.96873 °E-94.44644 9°	300 mt	Early morning, late evening	5%
12	Sivasagar	4	Deep agri-field	Bao rice	Vegetative	N-26.97493 6°E-94.47632 9°	200 mt	Early morning, late evening	5%
13	Sivasagar	5	Deep agri-field	Bao rice	Vegetative	N-26.93341 °E-94.44789 6°	250mt	Early morning, late evening	5%
14	Majuli	8	Deep agri-field	Bao rice	Vegetative	N-26.92979 5°E-94.13416 8°	500mt	Early morning, late evening	10%
15	Majuli	10	Deep agri-field	Bao rice	Vegetative	N-26.93395 7°E-94.26971 5°	300mt	Early morning, late evening	13%

16	Jorhat	7	Deep agri-field	Bao rice	Vegetative	N-26°57'26.8656/E-94°22'18.372"	500mt	Early morning, late evening	10%
17	Lakhimpur	8	Deep agri-field	Bao rice	Vegetative	N-27.22002°/E-94.043184°	300mt	Early morning, late evening	10%
18	Lakhimpur	15	Deep agri-field	Bao rice	Vegetative	N-27.122839°/E-94.148782°	500mt	Early morning, late evening	12%
19	Dhemaji	5	Deep agri-field	Bao rice	Vegetative	N-27.524562°/E-94.706021°	300mt	Early morning, late evening	10%
20	Dhemaji	8	Deep agri-field	Bao rice	Vegetative	N-27.524637°/E-94.705706°	400mt	Early morning, late evening	12%
21	Dhemaji	10	Deep agri-field	Bao rice	Vegetative	N-27.515653°/E-94.707484°	350mt	Early morning, late evening	8%
22	Dhemaji	12	Deep agri-field	Bao rice	Vegetative	N-27.517110°/E-94.707559°	500mt	Early morning, late evening	15%
23	Dhemaji	8	Deep agri-field	Bao rice	Vegetative	N-27.524523°/E-94.706124°	300mt	Early morning, late evening	10%
Average		8.13					360.86 mt		8.91 %

Identification of insectivorous birds (2015-19) as potential source for ecological balance demonstrates, Birds as Armyworm control agent in *Sali* rice, Beneficial birds to control soil insect pests and Identification of potential bird pollinators.

a. Birds as Armyworm control agent in *Sali* rice

After nearly 50 years, an “unprecedented epidemic” has hit Assam’s agriculture sector in the form of large- scale Rice swarming caterpillar (*Spodoptera mauritia*) attack on *Sali* paddy. As per report, about 30,000 hectares of crop land has been affected and paddy crops have been destroyed by the caterpillars in 22 districts of the state across the Brahmaputra Valley during the month of September 2016. A survey following transect method was done in the Army worm affected paddy field in five different locations of Lakhimpur district(*about 5800 ha paddy field was reported to be affected*) was done to record the predatory birds.

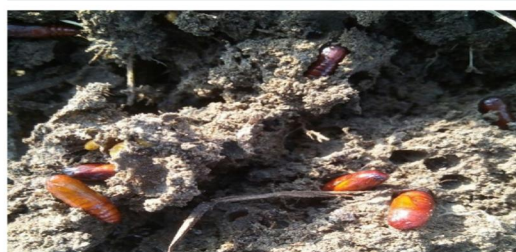
Results: Eight species birds were recorded as important bird predator of swarming caterpillar among which three species were found to be insectivorous and five were omnivorous species .Eastern Cattle-Egret was most abundant species followed by Common and Jungle Myna found as potential swarming caterpillar control agents.

Table.20.Predatory birds in Swarming caterpillar affected rice field

N= 1280

Sl No	Common Name	Scientific Name	% abundance
1	Eastern Cattle - Egret	<i>Bubulcus coromandas</i>	52.03
2	Common Myna	<i>Acridotheres tristis</i>	19.53
3	Jungle Myna	<i>Acridotheres fuscus</i>	14.68
4	Asian Pied Starling	<i>Gracupica contra</i>	5.23
5	Jungle Crow	<i>Corvus macrorhynchos</i>	4.21
6	House Crow	<i>Corvus splendens</i>	1.79
7	Indian Pond - Heron	<i>Ardeola grayii</i>	1.40
8	White-breasted water hen	<i>Amaurionis phoenicurus</i>	1.09

Swarming caterpillars in paddy field



b. Beneficial birds to control soil insect pests

Result : Eight species of birds recorded during a transect line and random survey in Lakhimpur district of Assam as major predatory birds of soil inhabiting insect pests, Among the species Eastern Cattle Egret was found to be more abundant species (42.03%) followed by common Myna (29.53%) and Jungle Myna (12.68%), Asian Pied Starling (7.23%), Jungle Crow (4.21%), House crow (1.79%), Indian Pond Heron (1.40%).

Table.21. Beneficial birds to control soil insect pests

Common Name	Scientific Name	% abundance
Eastern Cattle - Egret	<i>Bubulcus coromandas</i>	42.03
Common Myna	<i>Acridotheres tristis</i>	29.53
Jungle Myna	<i>Acridotheres fuscus</i>	12.68
Asian Pied Starling	<i>Gracupica contra</i>	7.23
Jungle Crow	<i>Corvus macrorhynchos</i>	4.21
House Crow	<i>Corvus splendens</i>	1.79
Indian Pond - Heron	<i>Ardeola grayii</i>	1.40
White-breasted water hen	<i>Amaurionis phoenicurus</i>	1.09

c. Identification of potential bird pollinators

Results: Birds belong to Nectariniidae followed by Dicaeidae & Zosteropidae are major pollinators. Plant families Lauraceae, Myrtaceae, Sapotaceae, Rutaceae, Rubiaceae & Symplocaceae are found to be benefitted by birds pollination services. Oriental White eyes and Sunbirds are predominant bird pollinator species recorded in Homestead agro ecosystem of NBP Zone of Assam

2. MONKEY

Monkeys have increasingly become pests in cultivated and human domesticated environments. Both in rural and urban areas, populations of common species of monkeys mainly *Macaca radiata* and *Macaca mulatta* have increased to proportions such that man and monkey conflict have become intolerable. Most of the agricultural and horticultural cultivable areas have become foraging and feeding areas.

Opinion based survey was conducted in different agroecosystems of four districts viz. Sivasagar, Dibrugarh and Jorhat (table 22) during 2018-19. The survey revealed the presence of only Rhesus monkey, *Macaca mulatta* in agro ecosystems. The population of monkey was

observed to be high in Sivasagar district (44) with male (9), female (24) and juvenile (11) in a troop. In all the locations female and juveniles outnumbered the male. The habitat of the monkeys was mostly observed to be the nearby forests from the people's living place. Feeding depends on their food preferences (table 23) and some crops are non-preferred by the monkeys. In majority of the places, people do not take up any measures to reduce monkey menace. Some measures that the people have adopted for minimizing the menace are use of slingshot and keeping dogs to guard the place.

Table 22: Opinion Survey of *Macaca mulatta* in Sivasagar, Dibrugarh and Jorhat districts of Assam

Sl.No	Variables	Categories	Site selected for opinion survey		
			Sivasagar	Dibrugarh	Jorhat
1	No. of population	Total	44	17	15
		Male	9	4	5
		Female	24	7	7
		Juvenile	11	6	3
2	Type of habitat	Nearby forest	62.5%	50%	57.14 %
		Bamboo groove	25%	-	42.86 %
		Tea garden	-	50%	-
3	Feeding	Most Preferred crop	Papaya	Banana	Papaya
		Non preferred crop	Chilli, turmeric, pineapple, ginger, colocasia, ladyfinger, toria, lemon, corriander, spinach, cabbage, ash gourd		
4	Perceived measures for minimizing the monkey menace	Keeping dog	31.25%	12%	42.85%
		Use of slingshot	6.25%	-	28.57%
		Use of stick	2%	-	-

Table 23: Different crops (%) that are not preferred by *Macaca mulatta* as food

Sl.	Crop	Scientific name	Family	(%)
1	Chilli	<i>Capsicum annum</i>	solanaceae	41.66
2	black pepper	<i>Piper nigrum</i>	Piperaceae	8.33
3	Onion	<i>Allium cepa</i>	Alliaceae	8.33
4	Ginger	<i>Zingiber officinale</i>	Zingiberaceae	45.83
5	Bitter gourd	<i>Momordica indica</i>	Cucurbitaceae	12.5
6	Ash gourd	<i>Benincasa hispida</i>	Cucurbitaceae	25
7	collocasia	<i>Colocasia esculenta</i>	Araceae	41.66
8	lady's finger	<i>Abelmoschus esculentus</i>	Malvaceae	45.83
9	Toria	<i>Brassica rapa</i>	Brassicaceae	70.83
10	mint	<i>Mentha virides</i>	Lamiaceae	4.16
11	turmeric	<i>Curcuma longa</i>	Zingiberaceae	41.66
12	spinach	<i>Beta vulgaris</i>	bengalensis	4.16
13	corriander	<i>Coriandrum sativum</i>	Apiaceae	12.5
14	cabbage	<i>Brassica oleracea v. capitata</i>	Brassicaceae	12.5
15	wheat	<i>Triticum aestivum</i>	Poaceae	4.16
16	pineapple	<i>Ananas sativus</i>	Bromeliaceae	12.5
17	Arecanut	<i>Areca catechu</i>	Palmae	20.83
18	coconut	<i>Cocos nucifera</i>	Palmae	12.5
19	lemon	<i>Citrus limon</i>	Rutaceae	12.5

In continuation of the habitat analysis and population distribution studies in the preceding years, along with Sivasagar, Dibrugarh, Jorhat surveys were also conducted in districts viz., Lakhimpur, Golaghat and Majuli. A total of 4062 individuals of *Rhesus macaque* were recorded in 84 troops from the different districts where highest number of individuals (1205) were recorded from Sivasagar district followed by Jorhat (844) and Lakhimpur (761). The peak feeding observations of monkeys were noticed between morning (6.00 to 10.00 hrs) and evening (16.00 to 18.00 hrs) (fig 11). Feeding of the monkeys mainly depend on their food preferences and some crops are non-preferred by them. It was observed that out of 84 peopled surveyed most (66.67) of them opined ginger to be the least preferred food. (fig 12). In majority of the places, people do not take up any measures to reduce monkey menace. Some measures that the people have adopted for minimizing the menace are use of slingshot and keeping dogs to guard the place.

Table 24: Population survey of Rhesus macaque in different districts of Assam

Sl.no	District	Observation (n)	Adult male	Adult female	juvenile	total
1	Sivsagar	28	270	671	264	1205
2	Dibrugarh	3	8	14	7	29
3	Jorhat	19	244	474	126	844
4	Lakhimpur	11	164	337	260	761
5	Golaghat	11	144	460	156	760
6	Majuli	12	106	256	101	463
	total	84	936	2212	914	4062

Fig 11: Incidence of crop raiding in different times of the day

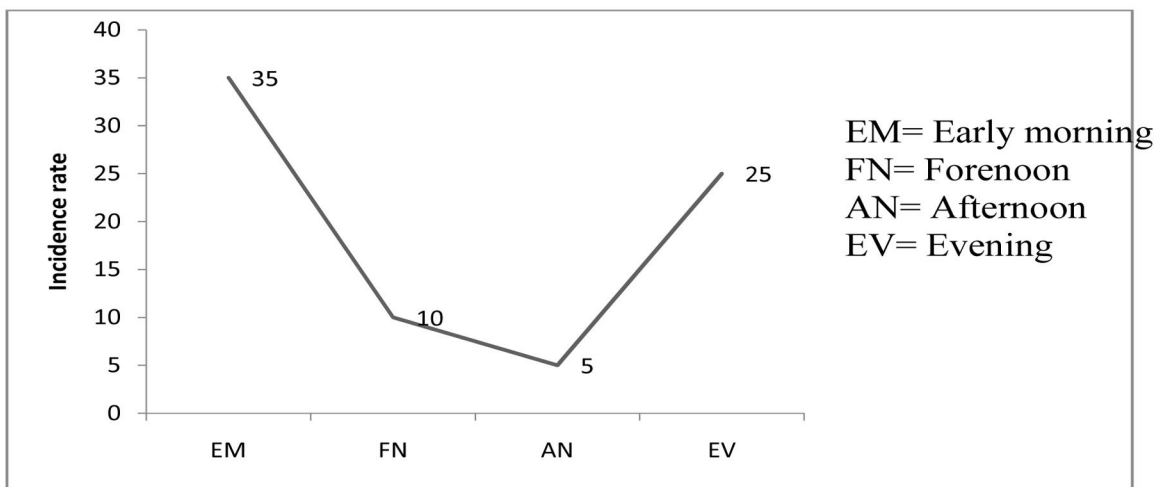
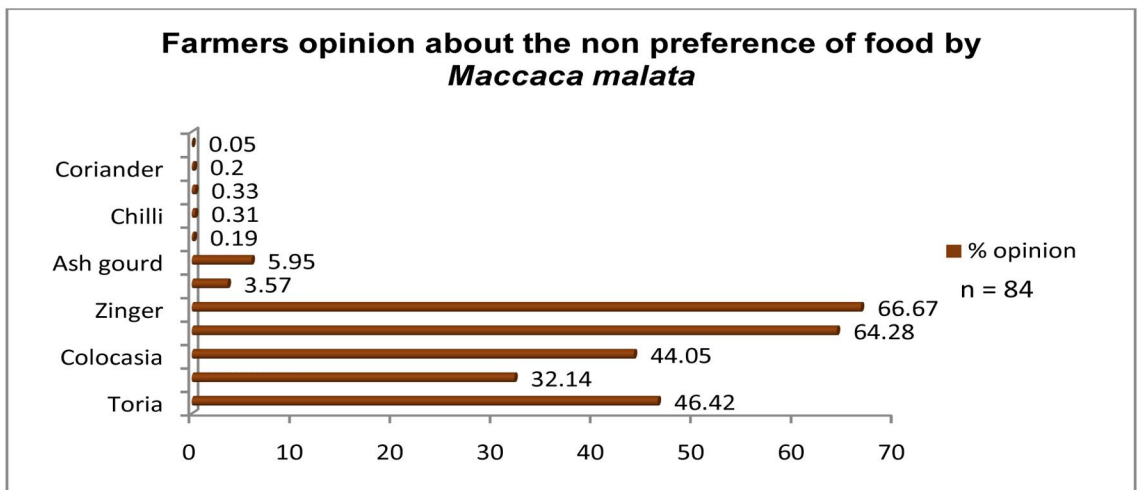


Fig 12: Farmers opinion on Non preferred crops by Rhesus monkey



During 2022-23 Population surveys were conducted in different districts viz. Sivasagar, Jorhat, Golaghat and Majuli. A total of 3941 individuals of *Rhesus macaque* were recorded in 62 troops in different districts where highest number of individuals (1641) were recorded from Majuli district followed by Jorhat district (845). A survey was carried out to identify crops not preferred by the monkeys. It was observed that out of 84 peopled surveyed from different locations, most (57.14%) of them opined for zinger crop to be the most un preferred food followed by turmeric(45.23% opinion). In majority of the places, people do not take up any measures to reduce monkey menace. Some measures that the people have adopted for minimizing the menace are use of slingshot and keeping dogs to guard the place.

Table 25: Population survey of Rhesus macaque in different districts of Assam

Sl.no	District	Observation (n)	Adult male	Adult female	Juvenile	Sex ratio	Total
1	Sivasagar	8	130	460	105	28.26	695
3	Jorhat	14	225	485	135	46.39	845
5	Golaghat	12	145	462	153	31.38	760
6	Majuli	28	309	1016	316	30.41	1641
	Total	62	809	2423	709		3941

Fig 12: Farmers opinion on Non preferred crops by Rhesus monkey

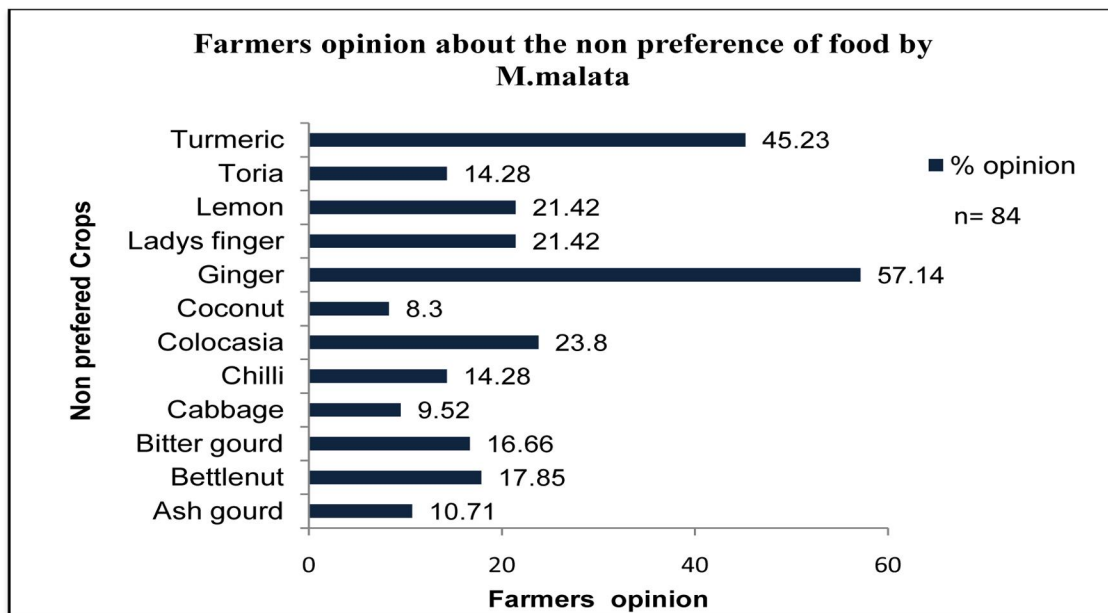


Table.26. Rhesus macaque population estimation in upper Assam districts

District	No. of groups	Population size	Av. Group size+-SE
Sivasagar	28	15-110	52+- 6.9
Jorhat	19	25-70	43+-6.8
Golaghat	11	35-180	68+-15.4
Majuli	12	20-60	36+- 5.1

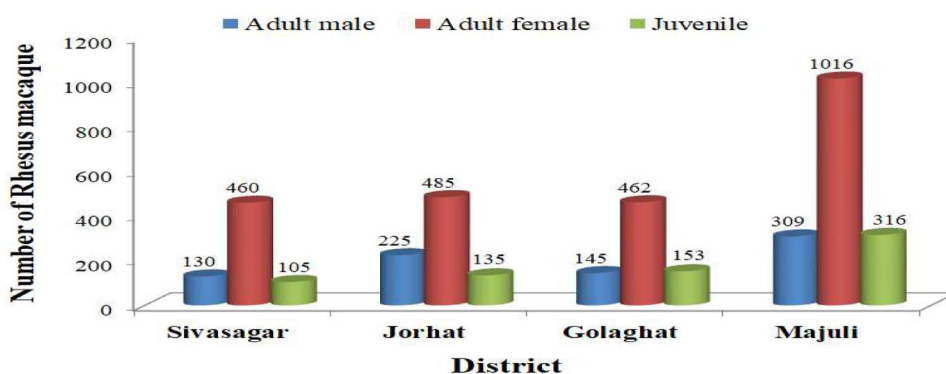


Fig. 13. : Rhesus macaque population in different districts of Assam

For deeper findings surveillance were conducted at different locations of Sivasagar and Charaideo districts of Assam. A total of 25 km transect walk was performed in 9 villages to estimate the population density. 195 individuals were encountered with a group size of 8-40. Density of Male, female and juvenile population was also recorded. Female and juvenile population was recorded higher indicated alarming situation in the village surveyed.

Table.27. Habitat analysis of *Macaca mullata* in different areas of UBZV district of Assam

Variables	Categories	Dhaibari, Nitaipukhuri	Jogorahabi,	Siripuria, Sivasagar
Area of damage(km)		3	2	2
Group no.		2	1	1
Group size	Total	30	20	15
	Male	8	3	4
	Female	15	12	7
	Juvenile	7	15	4
crop damage		50%	90%	60%

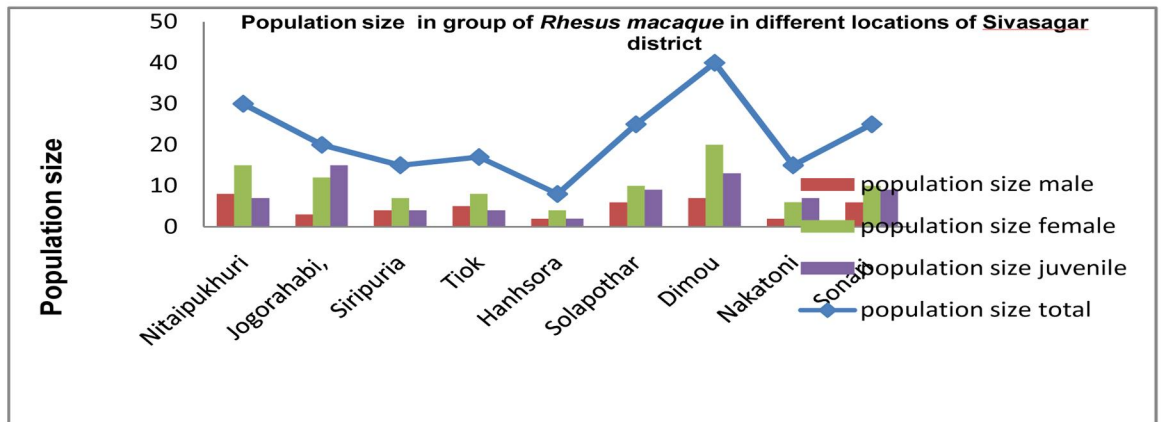


Table 28. Density of *Rhesus macaque* population in different locations UBVZ, Assam

Location	Transact (km)	No. of groups	population density/ km			Total
			Male	Female	Juvenile	
Dhaibari,Nitaipukhuri	3	2	2.6	5.0	2.33	30
Jogorahabi,Sivasagar	2	1	1.5	6.0	2.5	20
Siripuria, Sivasagar	2	1	2.0	3.5	2.0	15
Tiok,rajabari,Sonari	4	2	1.25	2.0	1.0	17
kujibali,hanhsora,Sivasagar	1	1	1.33	2.67	1.33	8
Solapothar,charaideo	3	1	2.00	3.33	3.0	25
Dimou,kinargoan	4	4	1.75	5.0	3.25	40
Nakatoni,kalugoan	3	1	0.67	2.0	2.33	15
Charaideo,Sonari	3	3	2.00	3.33	3.0	25
	25	16				195

Distribution of Rhesus monkey in Assam

Data received from seventeen districts of Assam on monkey affected villages. It is found that Tinsukia consist of highest number of villages affected by rhesus monkey followed by Charaideo, Bongaigaon and Lakhimpur. The population density of monkey was estimated at different locations of North Lakhimpur district covering Lakhimpur, Nawboicha, Narayanpur, Dhakuakhana and Ghilamara block. A total of 150 km transect walk was performed covering Ninety-two households that showed rhesus monkey individuals to range from 30 to 1000 in 1 to 2 number of troops. Based on questionnaire survey, damage percentage varied from 50 to 90%. In Lakhimpur district highest average individuals of 424 and damage percentage of 76% is recorded in Ghilamarablock, while the number of troops is highest in Naranyanpur block averaged to 2.9.

Table 29: Distribution of rhesus maqaue in Dhakuakhana block of North-Lakhimpur

Sl no.	Village	Number of troops	Radiu s in Km	Total individuals	% damage	Preferred	Non-preferred
1	Deolia	1	2	60	50	Paddy, Vegetables	Bittergourd, Ridge gourd
2	Amguri	2	7	150	80	Paddy, Vegetables, fruits	Ridge gourd, Lemon, colacasia
3	2 No.Thekeraguri	2	3	150	80	Paddy, Vegetables, fruits	Ridge gourd, Lemon, colacasia
4	1 No. Thekeraguri	1	2	400	80	Potato and paddy	Chilli, Bittergourd
5	GoroimariChapori	1	1	1000	60	Paddy, Vegetables, fruits	Bitter gourd, Ridge gourd
6	Kochuoni	1	2	400	80	Mustard,Paddy , Vegetables, fruits	Ridge gourd, Lemon, colacasia
7	Lowkuthmurutta	2	3	200	60	Mustard,Paddy , Vegetables, fruits	Bittergourd, Ridge gourd
8	Guwalgaon	2	1	500	70	Paddy, Vegetables, fruits	Bittergourd, Ridge gourd

9	Lahibari	2	4	1000	50	Paddy, Vegetables, fruits	Ridge gourd, Lemon, colacasia
10	GhataparaKath onichuk	2	2	60	70	Paddy, Vegetables, fruits	Bittergourd, Ridge gourd
11	Cherpating	2	2	200	80	Mustard,Paddy , Vegetables, fruits	Chilli, Bittergourd
12	Gharmara	1	2	500	80	Paddy, Vegetables, fruits	Ridge gourd, Lemon, colacasia
13	Kathalpara	1	2	500	70	Paddy, Vegetables, fruits	Chilli, Bittergourd
14	Madhupur	1	2	20	0	No damage	No damage
Average		1.50	2.50	367	65.0		

Table.30: Distribution of rhesus maquae in Naoboicha block of North-Lakhimpur

Sl no.	Village	Number of troops	Radius in Km	Total individuals	% damage	Preferred	Non-preferred
1	kholihamari	4	2	60	80	Paddy, vegetables,	okra, spinach
2	LothouJorhatia	1	3	2	00	No damage	Teasle gourd
3	BilotiaKathoni	2	3	30	60	Paddy, Vegetables	Okra, Bitter gourd
4	Perabhari	2	2	200	80	Paddy, Vegetables	Every Crop they eat or destroy
5	Naharbari	2	2	40	80	Paddy, Vegetables	Teasle gourd
6	Demowguri	3	5	100	90	Paddy, Vegetables, Pigeon and hen egg	eat and destroy everything
7	No.1 Kowadonga	1	2	2	0	No damage	No damage
8	No.2 Kowadonga	2	3	150	60	Paddy, Vegetables	Okra, Bitter gourd
9	Rangpuria	1	2	30	30	Paddy, Vegetables	Okra, Bitter gourd
10	Kamalpur	1	3	40	60	Paddy, Vegetables	Okra, Bitter gourd, Chilli
Average		1.90	2.70	66.0	54.20		

Table 31: Distribution of rhesus maquae in Narayanpur block of North-Lakhimpur

Sl no .	Village	Number of troops	Radius in Km	Total individuals	% damage	Preferred	Non-preferred
1	Rongotimisamora	2	1	60	50	Mustard, paddy,vegetables	Chilli, lemon
2	Duliapothar	1	1	300	60	Sali rice	Turmeric,Colacasia
3	Dakua	2	3	250	80	Pumpkin, Potato,Paddy	Okra,Chilli,Colacasia
4	1 no. pichala	2	2	150	60	Paddy	Chilli, lemon
5	Kochuauriamguri	6	4	100	80	Mustard, paddy,vegetables	Okra
6	Kasikota	4	2	150	90	Potato, papaya, paddy	Okra,teasle gourd
7	2 no. rangajan	4	1	200	90	Mustard, paddy,vegetables	Lemon
8	1 no.rangajan	3	2	100	90	Mustard, paddy,vegetables	Okra
9	2 no.tengapathar	1	2	50	60	Paddy	Okra, Bitter gourd
10	Majgaon	4	2	150	50	Potato,Paddy	Chilli, lemon
11	Chudhapunia	3	2	150	50	paddy,vegetables	Turmeric,Colacasia
Average		2.90	2.00	150	69.0		

Table.32: Distribution of rhesus maquae in Ghilamara block of North-Lakhimpur

Sl no .	Village	Number of troops	Radius in Km	Total individuals	% damage	Preferred	Non-preferred
1	Borajan Chapori	1	5	1000	90	Paddy, vegetables , fruits	Beetlenut, colacasia
2	Raidingya	1	3	60	80	Mustard, Paddy, Vegetables	Teasle gourd
3	Chinaigaon	2	4	700	70	Mustard, Paddy	Lemon, Chilli, bittergourd
4	Digholigaon	4	6	300	90	Mustard, Paddy	Chilli, lemon
5	Digholimohmara	1	2	60	50	Paddy	Okra, Bitter gourd
Average		1.8	4	424	76		

A total of 52 household and 14 villages were surveyed in Lakhimpur block. Average 350 numbers of rhesus macaque individuals were recorded in a village Lechaigaon. The surveillance data revealed average number of 1.84 troops in villages of Lakhimpur block and the total average number of individuals is 119.11 in an area of 2.22 average radius in kilometer causing damage on an average of 66.21%. The most preferred crops were Paddy and all most all vegetables and fruits while the least preferred crop was found to be Lemon, Bittergourd, flat beans & Matured white gourd

Table 33: Distribution of rhesus maque in Lakhimpur block

Sl no.	Village	Average Number of troops	Average radius (Km)	Average Individuals	% damage	Most preferred	Least Preferred
1	Bandorbari	2.00	2.00	60	66.0	Jackfruit, Mango, Green gram & Black gram, banana	Colocasia, lemon, turmeric
2	Chutiakari	1.66	2.00	136	76.0	Pumpkin, potato, papaya, jackfruit, Teasle gourd	Bittergourd, okra, lemon
3	Teliagaon	2.00	2.00	118	80.0	Potato ridge gourd,	Matured white gourd
4	Borgohain	1.25	2.70	150	65.0	Banana leaves, bettle, brinjal, litchi, hibiscus flower, paddy	Roselle
5	Dekhialgaon	2.00	2.00	68	65.0	Cabbage, okra, brinjal, paddy	White gourd
6	Athakotia	2.00	1.60	75	63.0	Vegetables, paddy, papaya	Lemon, pepper
7	Sonarigaon	2.00	1.60	2.60	46.0	Radish	Turmeric, chilli
8	Korchungpanitula	1.50	1.50	100	60.0	Paddy, mustard	Lemon
9	Soraimukhia	1.00	2.00	125	80.0	vegetables	Coconut, flat beans
10	Borkomolaboria	3.00	1.60	176	66.0	Potato, papaya	Bittergourd
11	Anaighoria	3.00	2.00	55	60.0	Potato, papaya	Bittergourd
12	Majortika	1.00	3.00	45	60.0	Vegetables	Lemon
13	Noragaon	2.40	3.20	207	80.0	Paddy, mustard	Lemon
14	Lechaigaon	1.00	4.00	350	60.0	Paddy	Lemon
Average total		1.84	2.22	119.11	66.21		

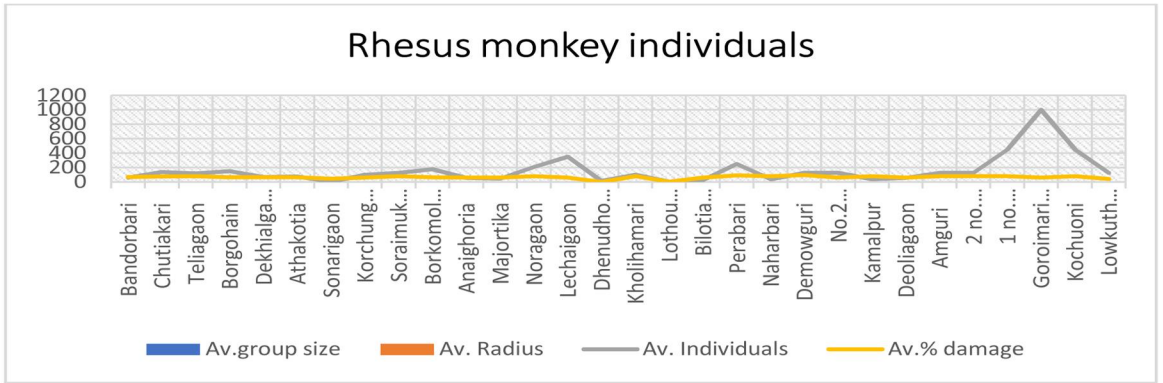


Fig.14: Rhesus monkey population in different blocks of Lakhimpur District

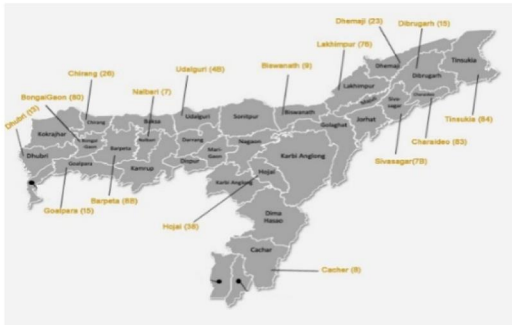


Fig.15 Groups of Rhesus macaque Fig.16 Highly affected districts by Rhesus macaque

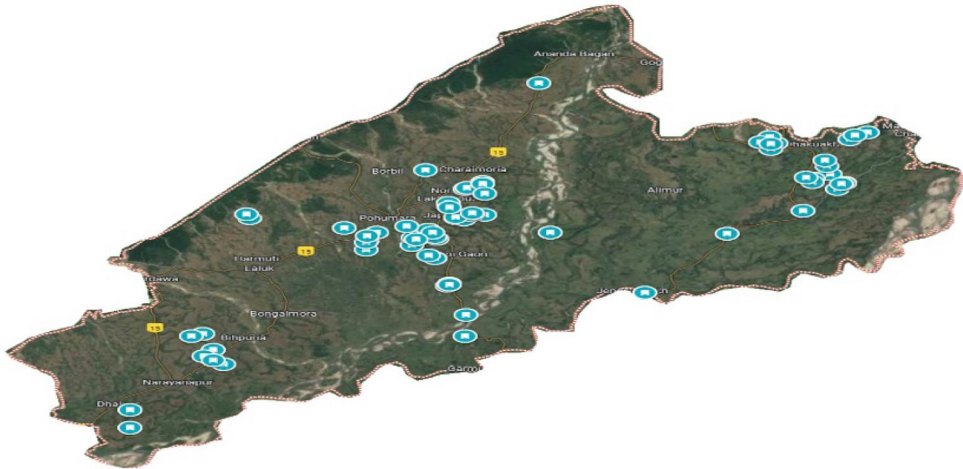


Fig.17 Population distribution of Rhesus macaque in Lakhimpur district of Assam

3.WILD BOAR

A survey on wild pig incidence in Assam was initiated from April to June 2024. Three development blocks viz., Orang, Biswanath and Behali under North Bank plain and two blocks viz., Raja Mayong (Pobitora) in Morigaon district and Kaliabor in Nagaon district under Central Brahmaputra valley zone of Assam . The wild pig affected crop fields were located nearer to Kaziranga Natural Park and Pobitora Wildlife sanctuary. Paddy field, Maize, vegetables, Chilli, Colocacia were recorded to be damaged by wild pig. A transact walk carried out in 5 villages (Table.34) in Bedeti block in Biswanath district during the month of June revealed pumpkin, potato , maize are most preferred crops by wild pig (Table 35).

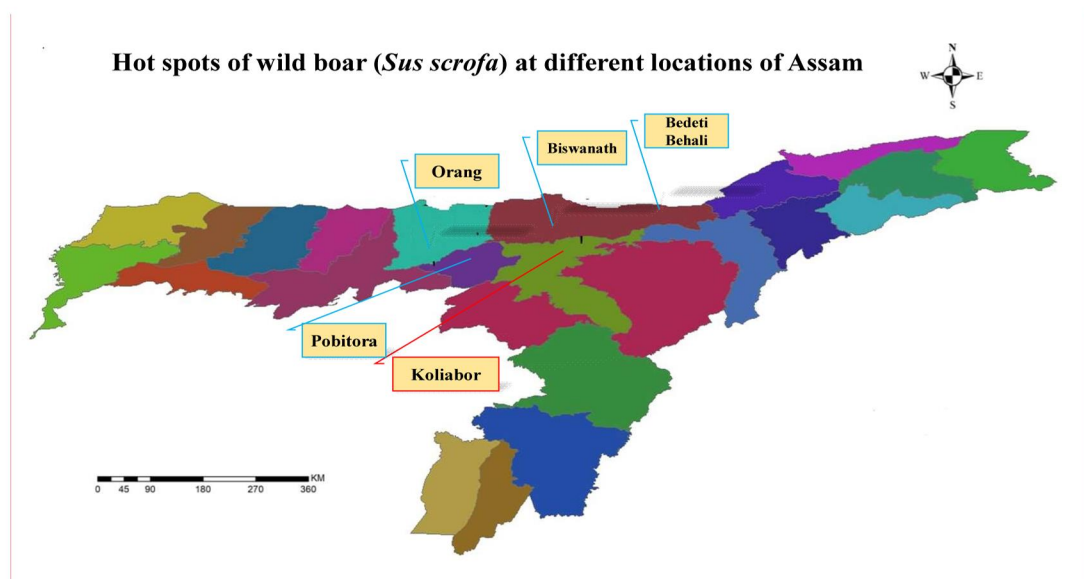
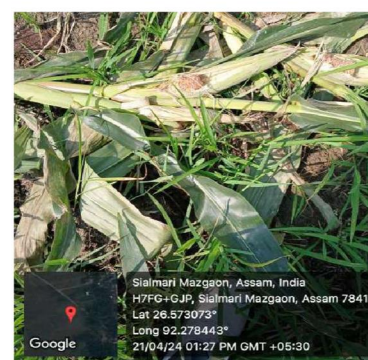


Table 34. Wild pigs Distribution study in villages of *Bedeti* block in Assam.

Sl. No	Agro ecological Region	Name of adjoining National Park/Wildlife sanctuary	Name of the District & Block	Date of observation	Name of the village	GPS location
1.	North Bank Plain Zone	Kaziranga National Park (6 th Addition)	Biswanath Bedeti	11-06-2024	No 7 Batia Mari	Lat 26.806067° Long 93.382829°
				11-06-2014	No 5 Batia Mari	Lat 26.802058° Long 93.383522°
				11-06-2024	Nepali Bari	Lat 26.783413° Long 93.386323°
				11-06-2024	Bedeti Guri	Lat 26.783413° Long 93.383622°
				12-06-2024	Rangsali	Lat 26.783413° Long 93.384225°

Table 35. Wild pig habitat study. Location: Bedeti.

Agro ecological Region	Crop	Habitat analysis
North Bank Plain Zone, Assam	Pumpkin,	Wild boar hurriedly eats most of the fruits and thus partially damages the fruits which become unmarketable.
	Potato	Gorge up the tubers and damage the whole crop.
	Chilli	Wild boar does not damage the vegetative parts of chilli but root up the ground around plant.
	Maize	Preferred part is dough stage cobs but whole crop is damaged.
	Colocacia,	They totally damage the crop by feeding the corm and stem.
	vegetables,	Damage is widespread damaging the fruits.
	Non food crop plants	Damage to roots by ploughing the crop vicinity.



Crops damaged by *Sus scrofa* & Hoof mark in maize field

Wild boar count realized during the different counting months near maize crop field at Rangali village of Biswanath district during 2024-25

Table 36. Wild boar count from Dec 2024 to March 2025 in Biswanath district of Assam

Sessions	Dec, 2024	Jan, 2025	Feb, 2025	Mar, 2025
Counting Nights (CNs)	1	6	8	12
Counting sites (CSs)				
a) By farmer	5	15	18	12
a) By trap camera	1	4	7	6
Camera trap failures (CFs)	0	2	3	2
Potential sampling efforts (CN X CS)	5	90	144	144
Effective sampling efforts (CN X {CS-CF})	5	78	120	120

4.RODENTS:

A. RODENT SURVEILLANCE IN RICE-RICE CROPPING SYSTEM

Method: Rodents were monitored in the *Bao* paddy of Regional Agricultural Research station of N. Lakhimpur by placing traps in the field to identify the rodent species and the level of incidence was estimated by the Live burrow count (LBC) for rodent incidence. Variety: Negheri bao

Result: The rodent species was identified as *Bandicota bengalensis*. The live burrows were observed from the 36th week of the calendar, 2020 in the vegetative stage of the crop. It was observed that the scale of incidence was low (18 nos.) at vegetative stage and it became moderate (31 nos) at the reproductive stage.

The burrow index scale being (per ha): low (0-25). moderate (25-50) and high (50 and above).

B.RODENT ABUNDANCE IN STORAGE CONDITION

Method: The rodents were monitored in the storage condition by using removal/kill trap method. 10 numbers of Rodent traps were set in different locations of the storage go downs in a distance of 10 m distance apart for trapping period of 7 days and were supplied with different baits to access the preference of food for trapping.

Results: It was also observed that *Rattus rattus* were predominant in the storage conditions. The result showed that trapping index was high that baits with fermented fish gave a comparatively more no. of catch (12) per 10 traps.

Table 37: Number of rats caught in the traps with different baits

Trap with bait	No. of rats caught in 7 days with 10 traps	Rodent Index scale
Bait with dry fish	7	0-10(low)
Bait with fermented fish	12	11-25(moderate))
Bait with fruits	4	0-10(low)
Bait with fermented meat	7	0-10(low)

C.RODENT SURVEILLANCE IN RICE-RICE CROPPING SYSTEM (DEEP WATER RICE)

Methodology: Live burrow count and trapping of rodents

Results:

- Two rodent species were identified:
Bandicota bengalensis *Mus boodoga*
- Live burrows were observed from September, 2021 and was peak with moderate incidence (38 live burrows) at November, 2021

D. RODENTS IN RICE FIELD AND GRAIN STORAGE IN LAKHIMPUR , ASSAM

Major two species recorded in Deep water rice field:

1. ***Bandicota bengalensis*** : Lives in burrows with dozen openings plugged with loose soil. They are abundantly found making burrows in deep water rice and also in bunds of *kharif* rice, vegetable crops.
2. ***Mus boodoga***: Also called as little Indian field mouse, its head and body length is around 6-7cm and tail length is 5-6 cm. They have a brown upper body with greyish white ventral surface. Muzzle is pointed. They have large round ears and a dark tail.

Major species recorded in storage structures:

1. *Bandicota bengalensis*
2. *Mus musculus*

The house mouse, *Mus musculus* is a small mammal that has a pointed snout, round large ears and almost a hairless tail. it has a body length of 5-10cm and tail length of 4-8cm. they are light brown to dark brown in colour. They are abundantly found in around storage structures.



Collection from barrier trap in the field

Rodents collected from storage

Mus booduga



Mus booduga



Trapped in rice Godown at AAU-ZRS, North Lakhimpur, February 2023

Chapter-2

ASSESSMENT OF YIELD LOSSES DUE TO VERTEBRATE PESTS IN PREDOMINANT CROPPING SYSTEMS

1. BIRDS: Bird Damage assessment in summer Rice

The damage caused by de predatory birds were assessed for different Hybrid Boro varieties of rice having different duration of the crop. The varieties were Indam 300-007, Indam 200022, PAC 8744, PAC 8744+ and PAC 837+. The assessment was carried out under netted and control(without net) conditions for all the varieties.

Results: The result showed that the early maturing *Boro* varieties were more prone to bird damage with 84.21% damage in Indam 20022 variety table (table 1)

Table 1: Damage caused by de predatory birds in different varieties of Boro Paddy in netted and non-netted condition

Name of the variety	Days to Fifty % flowering	Days to Maturity	Netted condition		Control condition (without net)	
			Damage %	Yield (kg)/ha	Damage %	Yield (kg)/ha
Indam 300-007	126 Days	162 Days	6.07	4136	40.8	2481
Indam 200022	120 Days	155 Days	5.15	5334	84.21	980
PAC 8744	133 Days	168 Days	3.62	4828	17.09	4634
PAC 8744+	129 Days	164 Days	3.97	5584	56.9	3238
PAC 837+	140 Days	175 Days	2.08	5235	12.71	5222

Table. 2. Yield loss assessment due to granivorous birds in *Boro* paddy in rice-rice cropping system

Observations	Protected with net	Control (Unprotected)	't' value
Panicle Damage (%) by Bird (Munia & Baya weaver)	4.70	49.75	18.44**
Yield (kg/ha)	4970.50	2833.30	26.03**

Result: Depredatory bird density = 41.71, Location: ZRSNL, Area 0.25 ha, yield data of 3 quadrates (2 mX2m)

Table. 3. Damage assessment due to parakeets in certain sugarcane varieties

Sl no.	Variety	No. of damage cane	Damage percent No. basis	Weight of damage cane (Kg)	Damage per cent weight basis
1	Dhansiri	23	10.60	10.3	8.66
2	Doiyang	39	15.48	15	12.10
3	Kakodunga	24	9.06	11.4	7.26
4	Nambor	26	10.74	9.5	7.85
5	Kolong	21	7.92	9.1	7.78
6	Luhit	20	9.22	8.9	5.86
7	Doria	42	15.11	18	12.86
8	Borak	47	16.26	19	11.88
9	Kopilipar	21	8.82	10.2	6.50
	't'- value		4.87**		5.64**



Sugercane damage by Parakeet



2. **Monkey:**The Yield loss by Rhesus Monkey was estimated in vegetable and fruit crops conducted in Sivasagar district .

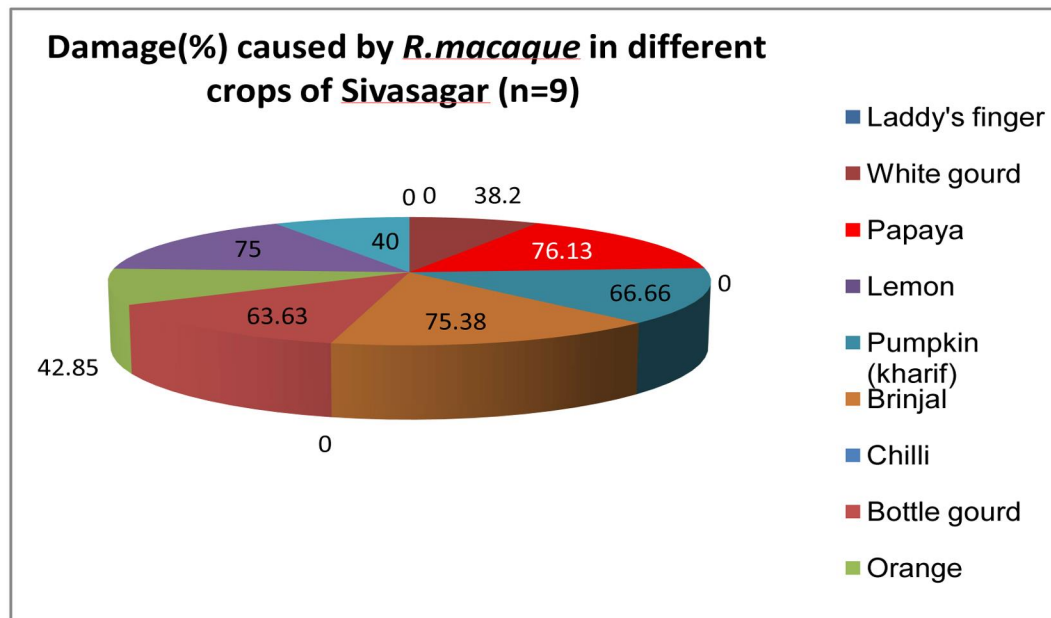


Table 4. Assessment of crop loss due to *Rhesus macaque* at Sivasagar.(N=9)

Crops	Crop produced (kg) in protected field	Damaged crops(kg) in control plot	Avoidable Crop Loss (%)
Lady's finger	25	0	0
White gourd	890	340	38.20
Papaya	880	670	76.13
Lemon	770	0	0
Pumpkin (<i>kharif</i>)	90	60	66.66
Brinjal	65	49	75.38
Chilli	35	0	0
Bottle gourd	110	70	63.63
Orange	210	90	42.85
Guava	20	15	75.0
Spine gourd	100	40	40.0
Jackfruit	10	0	0

Table.5.Extent of damage (%) caused by *Rhesus macaque* in *Rabi* crops in adaptive trials

Crops grown	Crops covered with Agri solar fencing(% damage)	Crops covered with HDPE net of 8 feet height (% damage)	Control plot (% damage)
Knolkhol	0	0	60
Brinjal	0	0	0
Bottle gourd	0	0	90
Green bean	0	0	90
Pumpkin	0	0	0
Spinach,coriander	0	0	10
Mustard	0	0	0
Chilli	0	0	2
Coriander	0	0	10

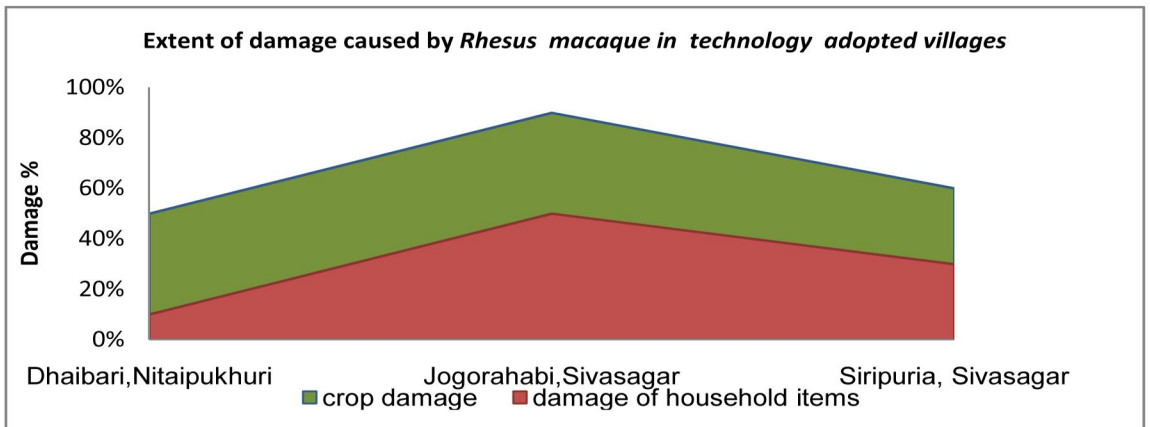


Table.6. Management strategies adopted by farmers against major vertebrates in experimental locations

During the year 2024-25 damage caused by rhesus monkey was assessed in six major *rabi* vegetables viz., Lofa, Pea, French bean, Knol-khol, Coriander, Turnip and Lettuce at four different locations viz., Chutiakari, Banderbari, Royabakal village and for Toria in Noragaon village of Lakhimpur district of Assam. Yield loss percentage varied from 77% to 88.50%. (Table.6,7&8). The damage percentage increased up to 100% in vegetables like French bean, coriander, Lofa and radish.

$$\text{Yield loss (\%)} = \frac{\text{Average yield in treated quadrates} - \text{Average yield in untreated quadrates}}{\text{Average yield in treated quadrant}} * 100.$$

Table:6. Yield loss assessment by rhesus macaque

Location: Chutiakari, (Lat. 27.168707, Long. 94.082691)				
Crops	No. of plants(1m²) (20days after sowing)	No.of plants (1m²) (30days after sowing)	Weight in kg (1m²) (60days after sowing)	Damage %(1m²)
Corriander	150	0.00	0.00	100.0
Radish	120	0.00	0.00	100.0
Lettuce	30.0	18.0	1.95	48.57
Lofa	50.0	45.0	0.60	29.41
pea	25.0	8.00	0.07	82.22
French bean	10.0	0.00	0.00	100
Average	64.16	11.83	0.43	76.70
Yield loss %	78.60			

Table: 7. Yield loss assessment by rhesus macaque

Location : Banderbari (Lat. 27.245852, Long.94.125304)				
Crops	No.of plants(1m²) (20days after sowing)	No. of plants(1m²) (30days after sowing)	Weight in kg (1m²) (60days after sowing)	Damage %(1m²)
Corriander	105	0	0.00	100.0
Knol-khol	15.0	6	0.86	82.85
Lettuce	35.0	5	0.50	87.50
Lofa	15.0	0	0.00	100.0
Pea	12.0	3	0.03	92.00
French bean	8.00	0	0.00	100.0
Average	31.66	2.33	0.23	93.72
Yield loss %	88.55			

Table:8. Yield loss assessment by rhesus macaque

Royabakal (Lat.27.154038,Long. 94.103616)				
Crops	No.of plants(1m ²) (20days after sowing)	No.of plants(1m ²) (30days after sowing)	Weight in kg (1m ²) (60days after sowing)	Damage %(1m ²)
Corriander	111	0	0.00	100
Knol-khol	8	4	0.60	82.0
Lettuce	30	7	1.95	87.0
Lofa	10	0	0.60	100
Pea	7	5	0.07	92.0
French bean	14	0	0.00	100
Average	30.00	2.66	0.53	93.5
Yield loss %	77.00			

3.Wild boar : Wild boar damage was observed across Paddy, Palm saplings and Pumpkin in selected villages of Rangshali, Kaliabor and Batiamari. The damage percentages ranged from 15 ± 5 to 45 ± 5 , with variation based on crop type. Paddy was most affected crop, with significant yield loss of 24000 kg (Table.9). The statistically significant value (<0.05) indicates wild boar activity had considerable impact on crop yield.

Table.9. Crop loss assessment due to wild boar in Rangshali and Koliabor during 2024-25

Crop	Place	Area affected (ha)	Sample Size (n)	Damage (%) (Mean \pm SD)	Estimated Yield loss (Kg/ha)	Total Yield Loss (Kg)	p-value
Paddy	Rangshali	100	20	30 ± 5	240	24000	<0.01
Palm sapling	Kaliabor	1	5	15 ± 5	55 saplings lost	55	<0.01
Pumpkin	Batiamari	20	10	45 ± 5	200	4000	<0.01



4.RODENTS:

ASSESSMENT OF RODENT DAMAGE IN THE DEEP-WATER RICE ECOSYSTEM

Method: The assessment of damage caused by the rodents were done by diagonal method of rodent damage protocol (Nirmala Srinivasa Rao). The damaged tillers were collected using diagonal method at 15 days of interval starting from 37th week (1st week of September) of the calendar year till the maturity and the results were calculated out.

Result:

Damage incidence showed that a maximum (45.29%) damage was caused in the maturity stage of the crop at 49th week (last week of November).

Table 10: Damage (%) caused by rodents in Deep water rice field at weekly interval.

No. of week.	% Damage
37th week	6.92
40th week	9
43rd week	14.87
46th week	27.19
49th week	45.29

RODENTS IN DEEP WATER RICE FIELD:

The rodents cause damage in almost all stages of the crop growth. They cut/ uproot newly transplanted seedlings of rice. They cut tillers diagonally at 5-10cm above the water level. Significant damage is observed at the time of active tillering and is higher during the early growth stages. The extent of damage ranges from 40 to 60% of tiller damage. The damage in standing crop is observed as isolated damage patches in the main field which may be moderate to high. Border rows sustain less damage as compared to the main field. A direct relationship of damage to the tillers and number of burrows exists. Rodents hoard grains in burrows and therefore more the number of burrows maximum will be the store capacity. The extensive burrowing may lead to soil erosion, damage to water channels etc.





Rodent damage in Deep water Rice field and Rice fallow season

TRAP BARRIER SYSTEM

It is observed that a large proportion of potential crop yield is lost in the farmers field due to rodent infestation ever year. While management of rodents depends greatly on application of rodenticides and traps, it is rarely economically sustainable as these are often applied only after the damage has occurred than a routine way. And it is difficult to estimate economic losses due to complex pattern of growth and recovery of plants related to the damage in different developmental stages of the crop. A trap barrier system as such may provide an alternative novel approach for controlling rodents in rice fields in a community-based way.

Materials and Method: Two locations were selected for TBS with different land situations viz. medium land at Phukon Doloni village in Lakhimpur district and low land (deep water system) at ZRS, North Lakhimpur. An area of 100m² for both the situations were taken where one is treated with TBS and the other untreated control. Polythene sheets were used to construct the barrier system with bamboo stands in between to keep it erect. The stands were put 2m above the ground and the polythene sheets were rolled around and covered with mud bellow the ground so that no rodent can penetrate these sheets. Live multiple cage traps are placed every 2.5m (n=8 per TBS) from each sides. These traps are installed along each side inside the fence held tightly against the fence with an opening hole. 2 kill traps are also placed inside the sheets.

Observation: Record was taken in terms of: Trap Index (Number of Removal trap catches), live burrow count (LBC) and damage % in both treated and untreated conditions.

Result: It was observed that the live burrow count (LBC) was lower in both the situations viz. Medium land and deep water rice situations. Damage assessment in medium land situation with TBS showed 8.91% damage of the crop while in the control plots the damage was 21.07%. In deep water land situation, the damage was observed to be 15.34% in control plot and 2.19% in land with TBS. The trap index was observed to be 32.14 in medium land situation of rice and 3.57 in deep water land situation.

Table 11. Rodent infestation and trap index in rice crop with different land situations

Particulars	Medium land with TBS	Medium land Control	Deep water land with TBS	Deep water land control
LBC	L (n=7)	M(n=28)	L(n=2)	L(n=7)
Damage assessment (%)	8.91	21.07	2.19	15.34
Trap Index/100 traps/night	32.14	-	3.57	-



Deep water situation of rice crop



Damage assessment



Rat trapped in kill trap



Live burrow in the TBS area



Medium land situation of rice crop



Rat trapped in multiple catch trap rice field

Chapter-3

DEVELOPMENT AND REFINEMENT OF MANAGEMENT TECHNOLOGIES FOR HIGHER VERTEBRATE PEST

A. BIRDS:

Evaluation effectiveness of Eco – gun and cob wrapping for management of Parakeet damage in Maize: The bio acoustic Eco gun and wrapping of maize cobs in outer three rows recorded 13.56 per cent cob damage against 44.47 per cent damage in untreated control plots found to be an effective management practice to protect maize crop from parakeet damage at cob formation stage. (Table 1).

Table 1. Evaluation effectiveness of Eco - gun against Parakeet in Maize

Treatment	Per cent Cob damage (pre harvest estimation)**
1. Eco-Gun + wrapping of cobs in 3 rows	13.56
2. Control	44.47
SD	21.11
Sem.	4.76
t	7.82*

Location: Mayong, Pobitora, 2023- 2024

Vertebrate Pest Management as farmers Participatory Adaptive Research in adopted villages: Proven technologies and technology under pipeline for vertebrate pest management recommended by different centres were demonstrated in 6.0 ha of area with active participation of farmers in 9 different locations spread over 2 districts and results and impact are presented. Damage caused by vertebrate pests and ITK used by the farmers are also recorded and presented (Table.2).

Table.2. Farmers participatory adaptive Research – Large scale Demonstrations

Farmer	Location	Area covered	Technologies
Sunil Neog	Dikhowmukh, Sivasagar	0.25 ha	Agri- solar fencing for Monkey management HDPE NET for Monkey management
NityaNeog	Nakatani, Sivasagar	0.25 ha	Rodent management in Deep water Paddy
Kamal Bora	Fesuchapori Lakhimpur	2.0 ha	Reflective Ribbon & Drive away

KushalT hegal Mohesw arMaha nta Bhaben Gogoi, Kanak Sipahi	Kuchiamari, Lakhimpur Naharani Karipukhuri GabharuTunujan Uriampora	1.0ha 0.5 ha 0.5 ha 1.5 ha	bird Repeller for depredatory bird management T- Perch and Barn owl nest box as a component of IPM in paddy field.
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Demonstration on HDPE Net for Protecting crops from monkey



Demonstration on used of Barn owl for rodent management & T perch for IPM



Demonstration on Rodent Management in Deep water rice field



Demonstration on Bird repeller "DRIVE AWAY"

Evaluation of Ecofriendly Insect Bird Pest Management (IBPM) techniques on different crops in farmers' field

Maize: Large scale demonstration of bird management methods in *Rabi* maize fields (6 ha) at Jiaguri and Katribari under Gosaigaon subdivision in Kokrajhar district & at Basugaon (5ha) at Basugaon in Cirang district showed higher yields in reflective ribbon + wrapping of cobs randomly with leaves in the three boundary lines recorded 90% reduction in parakeet infestation.



Ahu Rice: Technology demonstration in *Ahu Rice* in 1 ha (variety: Luit) at Roiya Bokol in Lakhimpur district showed that Reflective ribbon egg solution @ 20 ml/ lit recorded the damage caused by Munia and Weaver birds to the extent of less than 5% only

Seed treatment with Copper oxychloride @ 3 g/kg seed in Maize during *Rabi* showed high per cent germination followed by Reflective ribbon and over control.

Wheat: Technology demonstration in wheat at Amtola, Milik Basti and Daria Basti in Hojai showed reduced parakeet and Munia damage to wheat panicles while tie two parallel ribbon vertically, 20 cm apart by fixing it with the help of wooden/bamboo stakes on the outer edge of the row just 6 inches away from the panicles. The performance of jute string was at par with Reflective ribbon.

ECO FRIENDLY APPROACH FOR MINIMIZING BIRD DAMAGE:

Evaluation of different treatments showed that the grains damaged by birds was less in the crop covered with net (2.93%) followed by bird scarring reflective ribbon (5.17%) and eco-friendly chemical Ecodon (6.65%).

Table 3: Evaluation of different eco-friendly approach for managing bird damage in *Boro* rice

Sl.No.	Treatment	% grain damage
	Net	2.93
	Reflective ribbon	5.17
	ECODON @ 15ml/l	6.56
	COC @ 3g/l	7.50
	Egg solution @ 2%	8.45
	Multineem@ 20ml/l	9.64
	Control	12.9
	CV	9.72
	CD (0.05)	1.80

EVALUATION EFFECTIVENESS OF ECO-GUN AND COB WRAPPING AGAINST PARAKEET

Crop: Rabi Maize.

Location: ZRSNL, 2022- 2023

Table 4: Percent of damage in treated and control plots

Treatment	Per cent Cob damage (pre harvest estimation)**
1. Eco-Gun + wrapping of cobs in 3 rows	18.76
2. Control	59.30
SD	23.17
Sem	5.18
t	7.82*



A view of the experimental site

EVALUATION SELF MOVING *DRIVE –AWAY BIRD*

Bird damage is a common problem in *Boro* rice field of Assam especially during the heading and milk stages. Farmers often suffer grain loss caused by sparrows, Munia etc. Traditional scare methods are either labour-intensive or lose effectiveness quickly. The string-attached self moving drive away bird mimics large birds and its movement makes it more effective over larger area.

Design: 4 replications with distant-wise damage observations. (0-5m, 5-10m,10-20m,20-30m,30-40m,40-60m

Result: The self-moving drive away bird device was found to be effective up to 20-30m (25% efficacy) with strongest protection (69.60%) close to the device and minimal effect beyond 30m

Distance-wise efficacy

Distance from device	Damage (%) in Control	Damage(%) in Drive-away bird	Efficacy(% reduction)
0-5m	15.10	4.60	69.60
5-10m	15.00	6.70	55.30
10-20m	13.90	8.30	40.20
20-30m	14.20	10.60	25.40
30-40m	13.00	11.30	13.10
40-60m	12.90	12.30	4.70

*mean of 4 replications



Self moving, *Drive –Away Bird*

MANAGEMENT OF PARAKEETS IN SUGARCANE CROP

Objective: To evaluate different management strategies to control damage of sugarcane crop from parakeets.

Methodology:

Area of each plot=625m²

- Use of 3 rows of sugarcane crop as bio fencing
- Use of nylon netting
- Use of Bioacoustics (E- Cannon)
- Unprotected control

Per cent plant infestation was recorded based on non infested canes

Result: The rose ringed parakeet *Psittacula krameri* damage to the crop starts from October during the cane formation stage and damage continues till cane maturity stage. Use of nylon netting to fence the crop up to a minimum height of 10 ft. (3m) was found to be most effective in controlling parakeet's damage caused to sugarcane crop .Per cent infestation was recorded to be zero. Use of 3 rows of sugarcane crop as bio fencing was not found to be effective as the parakeet damage continued. Damage per cent in the periphery of the crop on the basis of numbers of damage cane was recorded to be 74% per cent. In case of use of Bioacoustics' device to used deter parakeets damage per cent in the periphery of the crop on the basis of numbers of damage cane was recorded to be 36% per cent

B.MONKEY

1.MONKEY SCARRING DEVICE AGRI CANNON :

Testing and demonstration of the Monkey scarring device Agri Cannon in different locations of Assam are being carried out and 3x2 cm size carbide bullets have been Standardized to be used in the Agri Cannon for its maximum efficiency.The Device (Agri Cannon) have also been tested in ICAR- NRRI, Gerua, Kamrup, Assam

Observations:

- A potential device to protect agricultural crops from monkey
- Easy and safe to use
- Cover an area of around 2 acres
- Harmless for human and monkey.
- Helps in deterring monkey from crop field for about 72 hrs with huge sound.

Reduction in labour cost and damage to crop

2.EVALUATION SOLAR FENCING TO PROTECT CROPS FROM MONKEY

Location: AAU- B.N. College of Agriculture, Biswanth Charali , Sonitpur district
(Collaboration: Dept. of Agronomy & Entomology)

Wildlife Human Conflict is on the rise owing to Encroachment, Fragmentation of Wildlife Habitats, Blockage of Traditional Migration Routes and Restricting Wildlife to

Small Patches. Lack of Food in the Forest and the Easy Availability of Nutritious Food. In The Agricultural Landscape have wild Animals Like Macaques (Monkeys), Nilgai, Blackbuck, Wild boar, Spotted Deer, Stray cattle, goat sheep etc., prone to human-wildlife conflicts, keeping this in view, a PJTSAU and Gamyam Technologies Pvt. Ltd. jointly developed a potential method to reduce the problem of intrusion by these higher vertebrates into the the agricultural landscape.

Depending upon the location, crops are damaged both by the large animals (such as Stray Cattle, Beer, Gaur and Niligai) as well as by the small animals (such as Spotted Deer, Blackbuck, Wild boar and Monkeys) that enter cultivated fields. In some areas there may be two or more species causing severe crop damage to the crops, e.g. Nilgai, Wildboar and Monkeys making the situation more difficult. Solution:

To minimize the human- wildlife conflict in agricultural crops, integrated Agri solar energizer solution is a promising technology, deters animals from agricultural & horticultural crop fields. The Agri solar energizer uses 12V input solar energy, generate electrical shocks to the higher vertebrates. The shock from an electric fence causes no physical damage to animals and humans beings etc., and if they are forced to enter the fence, experience mild jerk and thus helps saving of the crop from being damaged.

Solar Benefits:

- Compact design and easy to carry from one place to another place
- 10KV output voltage their by provides complete protection to the crop.
- The charging of the device is done through solar energy.
- If used properly the device will work for 8-10 years
- Achieve return on investment in 1-2 crop seasons.
- Protects agricultural crops from Wild boar, Monkey, Nilgai, Stray dogs, Stray Cattle etc.
- The device can be operated day and night.

According to battery capacity the extent of area can be increased (26 Ah battery covers -1 to 7 acres, 42 Ah battery covers-8 to 14 acres, 65 Ah battery covers-15 to 21 acres, 75 Ah battery covers -22 to 28 acres). Agri Solar Spare Parts: Solar Energizer, Solar Stand, Earthing Rod, Earthing Cable & Lead acid Battery

Components to be procured by farmers: GI Wire (1.65mm thickness), Reel Insulators, Corner Tightners, Bamboo Sticks Or Centering Sticks, Warning Sign Board & Springs ,S Hook

Result: An experiment was conducted at Biswanath College of Agriculture under Assam Agricultural University in the district of Sonitpur of Assam in 2000 sq mt area used as crop cafeteria of the college where about 100 different crops are grown throughout the year for demonstration and academic purposes both in Kharif and Rabi seasons. But the crops grown were damaged by wild animals' viz., Rhesus Macaque, Rabbits and Parakeets. Considering the situation AINP on Vertebrate Pest Management, AAU-ZRS, North Lakhimpur centre installed a solar fencing in the month of February, 2023 as specified above with 26 Ah battery capacity with 6 ft height, 8 numbers of GI wire at 15 cm gap up to 2 ft and rest at a gap of 1 ft using 2 inch PVC pipe cemented with a rod inside to reduce the cost for making durable but cost effective for farmers.

It was observed that most of the crops grown inside the solar fencing (table. 5) gave significantly higher yield as compared to crop yields recorded in the same plot without solar

fencing previous year. Crops grown outside the fence area were totally damaged by the monkey at reproductive stage.



A view of the experimental site at AAU- Biswanath college of Agriculture & at ZRS Lakhimpur

Table 5: Effect of solar fencing on yield of Rabi crops by reducing crop damage by Monkey

Sl. No.	Crop & Variety	Crop Yield (Kg/ha)		't' value
		2021-22 (without solar fencing)	2022-23 (with solar fencing)	
1	Sesamum var. Koliabor local	175.0	875.0	25.0**
2	Sesamum var. AST-1	112.0	781.0	45.8**
3	Ground nut var. Local	125.5	937.5	145.4**
4	Black gram var. T-9	62.5	1031.0	136.6**
5	Green gram var. Pratap	50.0	844.0	96.2**
6	Pigeon pea	250.0	1281.3	95.7**
7	Maize var. Ladhowal	562.5	1875.0	127.2**
8	Lathyrus var. Ratan	75.0	906.3	181.0**
9	Potato var. Pukhraj	875.0	5281.3	631.5**
10	Sorghum (Fodder)	3125.0	17500.0	99.6**
11	Pea (Grain) var. Hanit IPF	1062.5	3750.0	42.0**
12	<i>Sali</i> Rice var. Ranjit	125.0	3500.0	54.9**
13	<i>Boro</i> Rice var. Kanaklota	150.0	3187.5	279.3**
14	<i>Ahu</i> Rice var. Ronghung	112.5	1750.0	71.5**

Technology modification for adoption and acceptance

Solar fence with mulch paper enhance the efficacy and life of the wire by controlling the weeds, a major problem in Assam Using low cost plastic fish networks same as nylon HDPE to protect crops from Monkey



During 2024-25 an experiment was also conducted at Chutiakari village of Lakhimpur district in an area of 1 bigha. *Rabi* vegetables with Agri-Solar fencing recorded significantly higher yield compared to open field condition. Yield loss without protection exceeded upto 100% in vegetables confirming Agri-Solar Fencing provides effective protection against monkey menace in rabi season. The statistically significant results (<0.05) demonstrate the need for urgent management strategies to mitigate rhesus monkey related damage (Table 6) .It was observed that most of the crops grown inside the solar fencing (Table.6) gave significantly higher yield as compared to crop yields in the control plot. Crops grown outside the fence area were totally damaged by the monkey at different stages of plant growth from germination, seedling, vegetative growth, budding and flowering, fruit and seed formation, and finally, maturation and harvesting.

Table.6. Yield with and without Agri-Solar at Chutiakari village of North Lakhimpur

Crops	No. of plants(1m2) (20days after Installation)	No.of plants (30days after Installation)	Number of plants damage(1m2) due to monkey raid	Yield (1m2) in Kg with Agri-Solar	Yield (1m2) in Kg without Agri-Solar
Corriander	300	300	0	2.30	0.05
Radish	150	150	0	4.12	0.00
Lettuce	35	35	0	3.86	1.95
Lofa	70	70	0	0.85	0.60
Pea	45	45	0	0.44	0.07
French bean	35	35	0	0.51	0.00
Average	105.83	105.83	0	2.01	0.43

't'	2.60
'p'	0.04

3.EVALUATION OF HDPE NET FENCING TO PROTECT CROPS FROM MONKEY

HDPE, UV Stabilized 5cm mesh and 1.5mm thick. Net is fixed vertically using bamboo or wooden poles of about 3 meters (9 Feet) in height, in case of plot surrounded by dense tress or bamboo plantation otherwise 2 meters (6 Feet) in height and the net is then spread to about 60 cm horizontally over the ground by using small wooden pegs. If monkeys enter, it will be entangled and gives out alarm calls that deter other monkeys.

HDPE net acts as a good physical barrier. It is effective in preventing monkey's entry into the crop fields. It is a cost-effective method without harming the animal but protecting the crop. Saves manpower, costs and reduces crop losses by Monkeys HDPE net installed in three villages of North Lakhimpur district *viz.*, **Banderbari, Noragaon and Royabakal**

Rabi vegetables and toria with HDPE net fencing recorded significantly higher yield compared to open field condition. Yield loss without protection exceeded upto 100% in vegetables. The significant results (<0.05) demonstrate the need for urgent management strategies to mitigate rhesus monkey related damage (Table.7). Crops grown outside the fence area were totally damaged by the monkey.

Table.7. Yield with and without HDPE net fencing at Banderbari village o Lakhimpur Assam

Crops	No. of plants(1m2) (20 days after Installation)	No. of plants (30 days after Installatio n)	No. of plants damage(1m2) due to monkey raid	Yield (1m2) in Kg with HDPE net	Yield (1m2) in Kg without HDPE net
Corriander	400	400	0	3.03	0.00
Knol-Khol	35.0	35.0	0	5.02	0.86
Lettuce	40.0	40.0	0	4.00	0.50
Lofa	70.0	70.0	0	0.85	0.00
Pea	40.0	40.0	0	0.41	0.03
French bean	35.0	35.0	0	0.51	0.00
Average	103.33	103.33	0	2.30	0.23
't'	3.02				
'p'	0.02				

Table.8. Yield with and without HDPE net fencing at Royabakal village of Lakhimpur

Crops	No. of plants(1m2) (20days after Installation)	No. of plants (30days after Installation)	Damage %(1m2) due to monkey raid	Yield (1m2) in Kg with HDPE net	Yield (1m2) in Kg without HDPE net
Corriander	300	300	0	2.57	0.00
Knol Khol	35	35	0	5.60	0.60
Lettuce	35	35	0	3.65	1.95
Lofa	75	75	0	1.15	0.60
Pea	40	40	0	0.56	0.07
French bean	40	40	0	0.85	0.00
Average	87.50	87.50	0.00	2.39	0.53
‘t’	2.63				
‘p’	0.04				

The damage by rhesus macaque in toria plants was analyzed in Noragaon village of Lakhimpur district of Assam. For management of damage by monkey in *Toria* crop, HDPE net fencing was installed in an area of one bigha and simultaneously a control plot was maintained. Initially the HDPE net fencing was installed at a height of six feet, monkey intrusion inside the fence was recorded, therefore the height of the fence was increased to nine feet high, thereafter no damage and intrusion was observed. The weight of *Toria* plant in 1m² area was recorded to be 1.63kg, while the controlled plot recorded 0.60 kg (Table.9).

Table 9: Damage percentage in toria With and Without HDPE Net Noragaon, Assam

Name of crop	No. of plants in 1m ² (20 DAI)	No. of plants in 1m ² (25 DAI)	No. of plants in 1m ² (40 DAI)	No. of plants in 1m ² (60 DAI)	No. of plants in 1m ² (80 DAI)	Plant weight (1m2) in Kg
Toria with HDPE net	With net height of 6ft		With net height of 9ft			
	35	29.03	28.11	28.07	28.09	1.63
Toria without HDPE net	34.87	20.03	5.12	3.27	3.02	0.60
Survival (%)	99.60	69.0	18.20	11.70	10.80	

t	4.82	
p	0.004	

C.WILD BOAR: A demonstration was conducted to ascertain the efficacy of Repellent Based Formulation (**RBF**) against wild boar in *Rabi* maize and Pumpkin crop at *Rangshali* village near the sixth addition of Kazaranga National park under Bedeti block of Biswanath district in Assam. Three numbers of farmers were selected based on their interest to install the technology in their crop field.

Table 10: Basic information about the crop and location.

Sl. No.	Farmer	Village	Crop	Farm Location	Area	GPS
1.	Sanath Kumar Das	Rangsali	Maize	Edges	0.13 h	Lat:26.789207° Lon:93.37752°
2.	Bipul Das	Rangsali	Pumpkin	Middle	0.26 h	Lat:26.789224° Lon: 93.37747°
3.	Jiten Das	Rangsali	Pumpkin	Edges	0.26 h	Lat: 26.789241° Lon:93.377712°

The RBF pouches were installed in the crop field following the protocols provided by PAU Centre just after germination of maize (Variety – SHS 72) as damage by wild boar starts immediately after sowing. In pumpkin the repellent pouches were fixed after fruit set as damage starts thereafter. An ITK technology was also used in one of the farmers’ plots along with the control (no treatment), both in maize and pumpkin fields. The repellent bags were tied at the top of bamboo poles of one and a half feet and at a spacing of 4 meters. During peak winter, wetness was seen in the bags on morning hours.

The wild boar was counted both visually and with trap camera. The following observations were recorded. The RBF was found to be effective to minimize the yield loss in Maize and Pumpkin caused by the wild boar by repelling the wild animals from the field. The effectiveness may vary subject to weather parameters such as temperature, rainfall, humidity, wind etc.

Use of RBF for management of Wild boar: visit frequency of wild boar and damage status to different treatments in maize crop field at Rangsali village, Biswanath chariali was recorded during 2024-25.

Table. 11. Different treatment for control of wild boar

Sl. No	Treatment	Stage of Crop	Visit by wild boar	Damage recorded	Remarks
1	RBF	Seedling stage	2	Yes	-
		Vegetative stage	5	No	-
		Reproductive stage (dough stage)	3	Minimal	Started avoiding the route to the plot
		Harvesting stage	2	Minimal	-
2	ITK	Seedling stage	3	Yes	-
		Vegetative stage	5	Yes	-
		Reproductive stage (dough stage)	Damaged to young cobs	Yes	-
		Harvesting stage	Damage is significant	Yes	-
3	Control	Seedling stage	3	Yes	-

		Vegetative stage	7	Yes	-
		Reproductive stage (dough stage)	Crop totally damaged	No crop	-
		Harvesting stage	Crop totally damaged	No crop	-



Fig.10 Damage by wild boar in control plot



Fig.11. RBF treatment in maize crop

D.RODENTS:

TECHNOLOGIES Recommended for FARMERS 2019-2021

1.Barn Owl Nest-box for biological Rodent control

Install artificial nestbox in manmade structure or on tree trunk near to agricultural land where the rodent is abundant in the month of October at a height of 10-15 feet above the ground on a flat surface constructed by 19 mm (3/8) soft wood ply or soft wood with floor size of 16-inch x 18-inch and 18 inches height with entrance hole of 6 inches diameter, a removable lid and small side holes in both the sides for the effective conservation and propagation of Barn owl to control rodents in crop field and go down.

Detail of the Nest box designed by the AINPAO AAU, Assam at RARS, North Lakhimpur for the Barn Owl.

Nest boxes can be of great benefit, especially in areas where there is plenty of food available but a shortage of suitable nesting or roosting site. The Nest box for indoor installation was constructed from 19 mm (3/8) soft wood ply with 2 X 1 batten along the edges on the inside.

Size: 16-inch x 18-inch x 18 inches with a removable lid and side holes in both the sides for ventilation.

Entrance hole: 6 inches x 6 inches (6 inches diameter). The entry hole should be no less than 6 inches from the floor of the box. The box has a platform of 6 inches in front to give more airspace for you

owls to exercise their wings before their first flight. The boxes were installed so that hole can be easily seen by the hole during the flight.

(A tea-chest can be simply adopted by cutting an entrance hole, fixing on an exercise platform and adding a removable lid)

Ideal Time of installation of nest boxes for Barn Owl in Assam:

Month of October at a minimum height of 10 feet above the ground on flat surface so that nestling can walk on the surface

Chapter-4

LOCATION SPECIFIC STUDIES

a.PURPLE MOORHEN

i.Bio ecology & management of Purple Moorhen *Porphyrio porphyrio* in Rice

Study site: Gupalpur, Dikhow mukh, Sivasagar

Study period: March 2020 – December 2020

A flock of birds comprising more than 200 adult individuals was observed roosting in a marshy land with aquatic weeds and water hyacinth, birds feed on tender parts of water hyacinth and roots of aquatic plants during the month of March. Male female pairing was observed during mid-April to Ist week of June near the Deep-water paddy field, trampled paddy stem to make nest. Most of the birds in pair, reduced the size of the flock to less than 40 individuals, Made nests on thick paddy canopy. Egg laying observed during 10-16 July in 5 nests.

Nest number	No of eggs per nest	Mean
1	5	4.75 (range 3-8)
2	3	
3	6	
4	5	
5	8	

Most of the eggs were not noticed in subsequent visits. May be destroyed by predators. Egg hatching was observed only in one nest (nest no. 4) on 4 August. Hatching success was 60%. Incubation period around 3 weeks. Juveniles found foraging with adults during August to November in the wetland 100 mts from the paddy field.

In the third week of November birds in a group of 60-70 forage in the paddy field and feed on panicles of lodged DWR (Variety; Amona) and roost in the marshy land.

Observed that Purple Moorhen preferred micro habitat of aquatic plants for roosting and foraging.

Damage to DWR and management strategies

Heavy damage to DWR during vegetative, reproductive and ripening stage was observed. Netting in between the wetland and paddy field with fish net was found effective in reducing the yield loss.

Sample no	Panicle wt (gm)		Plot yield in gm (1 sq mt)	
	With net	control	With net	control
1	15.16	3.20	304.50	55.76
2	34.24	1.77	295.90	18.00
3	23.99	3.00	265.03	69.12

NB: Observed in 2 DWR field of 860 sq ft(with net) and 840 sq ft(control)

ii. Bio ecology & management of Purple Moorhen *Porphyrio porphyrio* in Rice

Locations: Gupalpur, Garsiga (Dikhowmukh) ; Gaurisagar,

District: Sivasagar

Study period: March 2020 – July 2021.

Results:

In 2020 : A flock of birds comprising more than 200 adult individuals was observed roosting in a marshy land with aquatic weeds and water hyacinth, birds feed on tender parts of water hyacinth and roots of aquatic plants during the month of March. Male female pairing was observed during mid-April to 1st week of June near the Deep-water paddy field, trampled paddy stem to make nest. Most of the birds in pair, reduced the size of the flock to less than 40 individuals, Made nests on thick paddy canopy. Egg laying observed during 10-16 July in 5 nests.

20-30% damage in Deep water paddy due to Purple moorhen was observed. Damage was found to be protected by erecting $\frac{1}{4}$ to $\frac{3}{4}$ inch nylon net in between wetland and crop field.

In 2021: Pairing observed in the month of May. First egg laying observed 1st week of May (4-6 eggs /nest). Incubated by both male and female. Egg laying observed in regular interval or alternate day. Nest building observed in the 2nd week of June 2021. Egg laying (5nos) observed on 29 June at Gaurisagar in a nest. 4 nos of nests observed at Gopalpurpothar with 6, 5, 7 eggs respectively in 3 nests only on 1st July. First egg hatching was recorded on 10 July. Hatching found to be completed on 22 July. Total incubation period 21 to 27 days. Juveniles have feather of black colour and white beak which turn red in adult. Most of the eggs were not noticed in subsequent visits. May be destroyed by predators. Egg hatching was observed only in one nest (nest no. 4) on 4 August. Hatching success was 60%. Incubation period around 3 weeks. Juveniles found foraging with adults during August to November in the wetland a few mtrs away from the paddy field.

Table 1: Egg laying and distribution of purple moorhen

Date	Area	Eggs	Hatching of eggs
29 th June,2021	Gaurisagar	5 nos.	Unrecorded
1 st July ,2021	Gupalpur	4 Nests observed with 0,6,5,7 eggs respectively	Started :10 th July,2021 Finished : 22 nd July, 2021

iii. Bio ecology & management of Purple Moorhen *Porphyrio porphyrio* in Rice

Locations : Gotonga Pathar, District : Sivasagar

Major Findings on bio ecology:

- No. of individual birds observed: > 200 adults.
- Roosting site: Marshy land filled with aquatic weeds and water-hyacinth
- Feeding habit: Birds feed on tender parts of water hyacinth and roots of aquatic plants during month of March
- Mating: Male female pairing observed during mid-April to 1st week of June near deep-water paddy field. Most flocks observed in pair
- Nesting: Nests are made on thick paddy canopy and build with trampled paddy stem.

Egg laying: Egg laying observed during 10-16 July in 5 nests .No. of eggs: 6

Management of the bird pest to be carried out during 2023-24



Nesting and breeding study on Purple moorhen at Dikhomukh, Gaurisagar

iv. Role of crop lands in attracting water birds to the Majuli River Island

Seasonal wetlands like croplands are reported to be the areas of waterbird significance since most water birds use them as foraging grounds. The objectives of the study is

1. To document the abundance and composition of water birds using croplands.
2. to evaluate the significance of croplands adjoining the open water habitat in attracting water birds, especially the migratory ones

Study site; Cakuli, Bhareki and Dakshinpat

Survey dates: 8 & 25 January, 2015

Parameter		Wetland Types		
		Agricultural land(cultivable+ grazing land)	Marshy land(partially inundated with vegetation)	Open water (water body without vegetation)
Total Avi fauna Richness(No)	141			
Waterbirds Richness(No)	57	39	27	27
% abundance	40.42	68.42	47.36	47.36

Water bird composition in wetland & Cropland habitats of Majuli

Bird Family	No. of spp	%
1.Phalacrocoracidae	2	3.51
2. Anhingidae	1	1.75
3.Ardeidae	9	15.78
4.Ciconiidae	3	5.26
5. Anatidae	16	28.07
6. Rallidae	5	8.77
7.Jacaniidae	2	3.51
8.Charadriidae	3	5.26
9. Scolopacidae	5	8.77
10. Laridae	2	3.51
11.Apodidae	1	1.75
12.Alcedinidae	4	7.01
13.Hirundinidae	2	3.51
14. Threskiornithidae	2	3.51

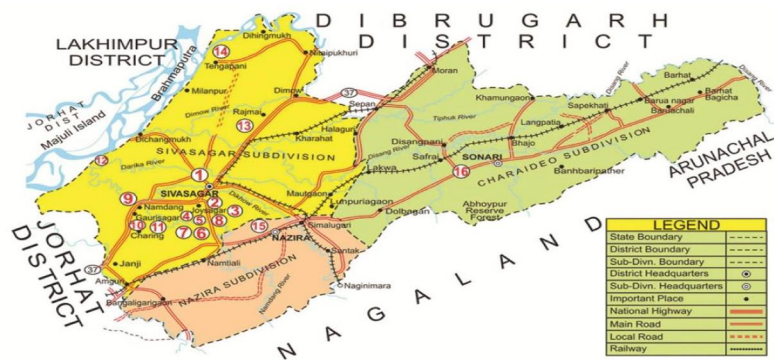
Result: A total of 141 bird species recorded at Study site viz., Cakuli, Bhareki and Dakshinpat belongs to 14 family of which 57 spp are water birds. Among these species 39 found forage in crop lands. Oriental White Ibis (NT) *Threskiornis melanocephalus* **first report from Majuli recorded in crop field.** Greater Adjutant Stork *Leptoptilos dubius* (EN) & Lesser Adjutant- Stork *Leptoptilos javanicus* (VU) were also recorded in crop field of Majuli.

b.SQUIRREL

i.Bio-ecology and management of squirrel (*Dremomys lokriah*) in Homestead garden

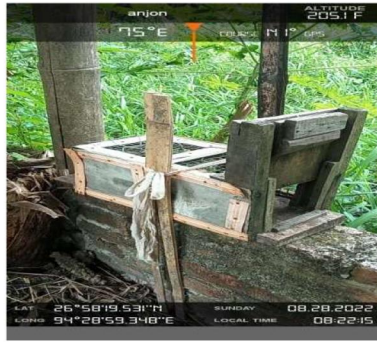
The study on bio-ecology and management of squirrel (*Dremomys lokriah*) in Homestead garden , an integrated horti- silvi farming system prevails in Assam was conducted from July 2022 to December 2022 in 12 villages of Sivasagar district under upper Assam. Crops damaged by the specific rodent were recorded.

- ✓ The nest making by the squirrel (*Dremomys lokriah*) was found to be initiated from the month of July-August. Dry bamboo leaves and banana leaves in evergreen with dense foliage trees viz., *Bamboo Jamun, Satian, Silikha* . Bamboo groves were most preferred habitat for breeding and nest making. They preserved seeds of trees like *Kadam (Raghu)* under soil for off season near the tree where nest were seen.
- ✓ 13 crops found in homesteads viz., Arecanut, Pomello, Coconut, Guava, Mango, Papaya ,Jackfruit, Banana ,Promegranate, Carambola, Rice grain, pumpkin, Bamboo shoots are most preferred foods.
- ✓ Trapping with locally made traps, baiting, noise making are common management tools recorded in the study area.
- ✓ Crows are reported to be major predator of the juveniles. The decreasing population of crows in the villages' one of the causes of increasing population of the species as opined by farmers.



Map 1: Sivasagar District of Assam, India





Bio-ecology,, nesting, feeding , damage and management of squirrel (*Dremomys lokriah*) in Homestead garden in Sivasagar district

Table .2: Occurrence and incidence of Squirrel in different homestead of Sivasagar district

Location /village	Homestead owner	Crop damaged	Activity observed/ number
Raghubari	Anjan Borthakur	Guava,Jackfruit,Mango, Banana,Promegranate,Coconut, Carambola	1 sub adult on 4 July 2022
Nakatani Kalugaon	Rajiv Hazarika	Arecanut, Orange, Guava, Mango,Papaya	3 nos were observed feeding on Guava. out of 230 counted 23 found damaged on 28 August 2022
Seuipur	Dhiren Barua	Coconut, Banana, Ber, Pomello, Amla, Mango Jamun, Arecanut, Pear	4/7/2022
Ujoni Bharalua	Jintu Dutta	Mango, Guava,Arecanut, Bambo shoot	4/7 22
Ujoni Bharalua	Jayanta Dutta	Mango, Pomello, Ber, Peach	4/7/22 pomello 11 out of 53
Na dicial	Pobon Rajkhowa	Arecanut, Mango, Pamello	8/7/23
Na dicial	Arun Neog	Jamun, Pomello, Arecanut, Coconut	10/7/22 Seen a pair to make nest with dry Bamboo leaves and dry banana thrones in Jamun tree
Bharalua	Haresh Kakoty	Rice in <i>Bharal</i> , Coconut	<i>Raghu</i> seed covered by Squirrel to keep for future
Maglow Raghubari	Kinu Bora	Pomello	19/8/2022 30 damaged out of 140
Dikhowmukh	Bubul Dutta	Pomello	27/8/23 10 out of 250
Maglow	Meera Barua	Guava	28/8/2023 50 out of 800
Ujani Bharalua	Anil Hazarika		10 /9/22 nest making in Bamboo grove
Ujani Bharalua	Binanda Dutta	Papaya	A pair observed of making nest on a Satian tree on October 20 , 2022
Gual gaon	Dadu Bhuya	Rice in <i>Bharal</i>	3 on November 7, 2022
Seujpur	Dhiren Barua	Coconut	15 November 2022
Na katani	Suresh Bhuya	Pumpkin in <i>Bharal</i>	19 December 2022
Kalugaon	Hemanta Bora	Rice in <i>Bharal</i>	21 December , 2022

ii. Studies on bio-ecology and management of squirrel *Dremomys lokriah* in horticultural/Agricultural/Plantation crops.

Nesting was observed 15-20 ft above ground in Bamboo groves (80%) and in evergreen trees with dense foliage made of leaves and small branches with foliage. Breeding initiated from the month of July. Active throughout the day but mostly early morning hours. Major problem in homestead garden and in traditional paddy storage structure (*Bharal*) Evaluation on effectiveness studies of a locally made trap in Homestead Farming System for squirrel *Dremomys lokriah* has been initiated in homestead garden. Extensive damage in tender and about to mature areca nut was observed on the nut bunches. Matured pomelo (*Citrus maxima*) fruit, banana are other heavily damage fruits in homestead garden. Crown baiting with bromadiolone (0.005%) and banding with aluminium sheet of 4 ft wide at 8 feet above the ground around the coconut tree reduces the infestation where the trees were planted in recommended distance (7.5m x7.5m) or in isolated place. infestation was found to be less in homestead garden with mono plantation of areca nut with recommended distance (2.75 m X 2.75m) than garden with other fruits and agro forestry components. Details bio ecology and management aspects will be carried out in 2022-23.



Chapter-5

EXTENSION ACTIVITIES, RESEARCH PUBLICATIONS & TECHNOLOGY DETAILS AND ITS IMPACT

Extension activities help in transferring scientific knowledge and technologies from research institutes to farming communities for managing vertebrate pests such as rodents, birds, monkey, wild boar and others. It includes a combination of on-farm trials, farmer-participatory research, capacity building initiatives, tribal support programs and structured feedback mechanisms enabled the systematic dissemination of eco-friendly, cost-effective and scalable interventions.

Sl.no.	Year	Title of the Training
1	2014-15	Ecosystem services of Birds in Agro ecosystem
2	2015-16	Pesticides pollution and eco friendly insect and bird pest management at Khonamukh
		Awareness meeting on important of birds in agricultural landscape at Dikhowmukh
		Awareness workshop on eco system services of birds at LTK College
3	2016-17	Training and demonstration for tribal farmers adopted technologies developed by the center to scare depredatory bird in DWR
		Training and awareness programme for tribal women farmers from Dhemaji District.
		Training and awareness programme for tribal women farmers from Dhemaji District.
		Field day on demonstration T-Perches for attracting predatory birds in mustard field
		Farmers scientists interaction on eco friendly insect and bird pest management
7	2017-18	Role of bird in agriculture student scientist interaction programme
		Training cum distribution of bird scaring ribbon for rabi crops and boro paddy
		Farmer workshop on IBPM on <i>boro</i> paddy
		Awareness meeting on important of birds in agricultural landscap at Dikhowmukh
		Training programme on IBPM on Oil seed and Rabi vegetable
		Training cum demonstration on eco friendly insect pest management on Mustard utilizing predatory bird
		World sparrow day
Training on utilization of bird in agro eco system		
8	2018-19	Training on IBPM in <i>Boro</i> paddy
		Demonstration on Maize
		<i>Boro</i> seed distribution and training
		World sparrow day
9	2019-20	Improved production technology of Toria
		Farmers scientists interaction
		Production technology and vertebrate management in summer paddy
		Farmer scientist interaction
		Eco friendly insect pest management utilizing predatory birds

10	2020-21	Improved production technology of Toria and pest management
		Farmers scientist interaction
		Hands on training on vertebrate pest management
		Hands on training and input distribution on vertebrate pest management
		Hands on training and input distribution on vertebrate pest management
		Awareness programme on world sparrow day 2021
		Training cum demonstration on use of agri-cannon to manage monkey problem in crop field
11	2021-22	Training on integrated rodent and insect pest management
		Awareness workshop on vertebrate pest management
		Hands on training on integrated rodent and insect pest management
		Observation of World sparrow day
		Training and demonstration on integrated management of rodent and depredatory bird in boro paddy
12	2022-23	Hands on training on TBS for rodent management
		Training on ecology based insect pest & rodent management
		Awareness meeting on barn owl conservation and its impact on agro eco system
		Training on package of practice (PoP) and integrated bird and pest management (IBPM) in toria
		Training on recent advances in vertebrate pest management ICAR-AINP on VPM
		Testing, training and demonstration on using of solar fencing and electronic device to minimize Monkey and birds menace in crop fields at BNCA, AAU, Biswanath.
13	2023-24	Hands on Training on use of Bioacquoastic for the management of Vertebrate Pest in Agriculture
		Hands on Training for Vertebrate Pest Management in Agriculture
		Training on Vertebrate Pest Management in Homestead Garden
		Awareness Meeting and Input Distribution (Rabi Veg. seed & Rat traps)
		Training on Vertebrate Pest Management (Bird)
		Awareness -Training & Workshop (World Sparrow Day)
		Training on Vertebrate Pest Management
		Training on Vertebrate Pest Management
		Awareness Training on Bird Conservation in Agricultural Landscape

EXTENSION ACTIVITIES DURING 2024-25

Sl no	Title of training/exhibition	Date	Type of participants	No. of participants
1	Hands on Training on management of vertebrate pests in Agriculture and Input distribution programme	19.08.2024	Farmers	33
2	Agri solar Distribution & Training	06.09.2024	Farmers	34
3	Hands on training on Bio- acoustics	25.09.2024	Farmers	25
4	Hands on training and Agri solar Distribution	16.10.2024	Farmers	35
5	Hands on training and Agri solar Distribution	19.10.2024	Farmers	28
6	Hands on training on use of HDPE net for monkey management in crop field and input distribution programme	29.10.2024	Farmers	36
7	Agri solar Distribution & Training	06.11.2024	Farmers	27
8	Hands on training and demonstration different techniques and strategies for rodents management	02.01.2025	Farmers	26
9	Training on VPM technologies	19.01.2025	State level officials	50
10	Training on PDUAM	27.01.2025	Farmers	27
11	Hands on training and demonstration on management of rodents and monkey in crop field	29.01.2025	Farmers	33
12	Hands on training and demonstration on management of rodents	14.02.2025	Farmers	25
13	Input distribution and training on VPM under TSP	15.02.2025	Farmers	25
14	Training programme on ICAR-AINP VPM	25.02.2025	Farmers	26
15	World sparrow day	20.03.2025	Farmers	80
16	Farmers scientist interaction	26.03.2025	Farmers	201
17	Hands on training and demonstration on management of rodents	27.05.2025	Farmers	28
18	Seed grower meet	31.04.2025	Farmers	71
19	Training on VPM	24.06.2025	Farmers	20
20	Agri solar Distribution & Training	26.06.2025	Farmers	41
21	Training on VPM	27.06.2025	Extension functionaries	37
22	Awareness meeting on VPM	07.07.2025	FPO's	32
23	Learning sharing programme on management of purple moorhen	17.07.2025	Farmers	17
24	Street corner programme on management of rhesus monkey under AINP on VPM	18.07.2025	Farmers	20
25	Hands on training on VPM	19.07.2025	Farmers	22
26	Street corner programme on management of rhesus monkey under AINP on VPM	24.07.2025	Farmers	24
27	Agri solar Distribution & skill Training in Sali rice	31.07.2025	Farmers	29
28	Awareness programme for rawep students and host farmers on VPM	22.08.2025	Farmers	11
29	Hands on training and demonstration on management of rodents and monkey in crop field	28.08.2025	Farmers	27
30	Street corner programme on management of rhesus monkey under AINP on VPM	01.09.2025	Farmers	16

Kisan Mela& Exhibition under Tribal Sub Plan :

Sl.no.	Year	Event	Duration (Days)	Total Participants
1	2016-17	Bird Bio-diversity fair ; organized exhibition, awareness meeting followed by distribution of bird scaring devices and nest boxes	1	75
2	2018-19	Zonal farmer meet & Agri Exhibition 2018	1	500
3	2019-20	Zonal farmer meet & Agri Exhibition 2019	1	335
4	2022-23	Farmers interaction exhibition and felicitation at RARS, NL	1	115

Important Events organized (2023-24)

Sl No	Title of Event	Organized by	Period	Sponsored by	Venue
1	Zonal Level Farmers Meet -2023	AAU-ZRS, NL	Day long	ICAR	AAU-ZRS, NL
2	Scientist-Farmers Interaction	AAU-ZRS, NL	Day long	ICAR	AAU-ZRS, NL
3	Agri-Exhibition	AAU-ZRS, NL	Day long	ICAR	AAU-ZRS, NL

Research publications are scientific documents that contains the findings, experiments and innovations related to the vertebrate pest management that helps in sharing knowledge among scientist, students and policy makers.

Research Publication

Saikia Prabal (2015). Identification of Rodent and Insectivore Prey Species in diet of Barn owl, <i>Tyoto alba</i> Stertens by Pellet Analysis. In <i>Proc. National Seminar on 'Harnessing Science for Societal Development'</i> . 60 th Annual Technical Session, Assam Science Society, Assam Agricultural University, Jorhat, 21 March, 2015. Pp52-55
Saikia Prabal (2016). Checklist of Birds of Dakhinpat Satra in Majuli : the biggest River Island of the world. <i>Green Letter</i> , 35(13): 2-6
Saikia Prabal (2016). Diversity of birds in Agricultural landscape of Northern Assam. In <i>Proc. UGC sponsored National seminar on Biodiversity degradation and its impact with special reference to North East India</i> 18-19 February, 2016, Madhabdev College, Assam. Pp.13-16
Saikia Prabal . (2018). Bird diversity in agricultural landscapes of Majuli River Island, Assam. In <i>Proc. International conference Climate changes, Biodiversity and sustainable Agriculture (ICCBSA-2018)</i> . 13-16 December, 2018 , AAU ,Assam
Rohila , M; Roy, P; Chowdhury, D; Sharma K; Prabal Saikia and Mondal Tapan (2019). <i>Bao Dhan</i> of Assam: organically grown indigenous rice slated to increase farmer's income. <i>Current Science</i> 116 (5): 707-708,
Borkotoki B; Das .K. N. Basumatary, A and Prabal Saikia (2019). Effect of STCR fertilizer prescription combined with IPNS on performance of normal and late sown Toria <i>J. Soils and Crops</i> . 29 (2):391-395
Saikia Prabal (2019). Implementation of Tribal Sub Plan activities in Assam, <i>Rodent Newsletter</i> , 43 (4), 13-14

Gogoi N. K; Chowdhury D.; Saikia Prabal and Sharma, K. (2020). Screening of Red-kernelled Deep-Water Rice Germplasm of Assam, India for Disease and Pest Resistance. <i>Int.J.Curr.Microbiol.App.Sci</i> 9(11): 487-496.
Borkotoki B; Sarma Banashree; Sarma K and Saikia Prabal (2021) . Modified Homestead Method of <i>Azolla</i> Cultivation: A Novel Low – cost Farming Method, <i>Journal of Soils and Crops</i> , 34(2), 197-203
Saikia Prabal 2022 . Emerging trends in Environment conservation and Eco friendly Pest management In <i>Proc. National Seminar Emerging trends in Environment – conservation –public awareness</i> . Madhabdev University, Assam , 8 April, 2022
Saikia Prabal.2023 . Traditional knowledge for Pest Management. In <i>Proc. National Conference on DHARA : Bharatiya Paramparik Krishi Mela Ministry of Education, GoI</i> , Tezpur University, 04-06 June 2023
N.K. Gogoi, Prabal Saikia and M. Saikia. 2023. Promotion of sustainable livelihood security of tribal farmers of Dhemaji district, Assam through scientific maize cultivation and pig rearing. In <i>Proc ICBFSCC - 2023 AAU, Jorhat, April 2023</i>
Saikia Prabal.2023 . Agricultural Ornithological Research at Assam Agricultural University. In <i>Proc ICBFSCC -2023 AAU, Jorhat, April 2023</i>
N.K. Gogoi, D. Chowdhury, Prabal . Saikia and M. Saikia. 2023. Impact of improved production technology of mustard (<i>Brassica juncea</i>) in Dhemaji district of Assam through Frontline Demonstrations In <i>Proc ICBFSCC -2023 AAU, Jorhat, April 2023</i>
Saikia Prabal.2023 . Bird diversity in agricultural landscape. In <i>Proc.International conference Next-Gen Preparedness for Food Security and Environmental Sustainability</i> . 22-24 November 2023 AAU-ARRI, Titabar, Assam
Borkotoki B, Bhattacharyya, D; Sharma, K and Saikia Prabal (2024) . Soil nutrient mapping of the Lakhimpur district of Assam using geospatial technology. <i>Annals of Plant and Soil Research</i> 26(1): 1-13 https://doi.org/10.47815/apsr.2024.10326
Saikia Prabal and Phukon Bithika (2024). Reproductive cycle of Barn Owl <i>Tyto alba</i> in artificial nest box and diet analysis in agro- ecosystem of Assam. In <i>Proc. National conference on Achieving sustainable goals in challenged Agro ecosystems</i> March 03-05, 2024, ICAR-CAZRI, Jodhpur
Phukon Bithika and Saikia Prabal (2024) . An eco-friendly, low cost Drive Away ITK artificial dummy bird for management of bird pest nuisance in agricultural field. In <i>Proc. National conference on Achieving sustainable goals in challenged Agro ecosystems</i> March 03-05, 2024, ICAR-CAZRI, Jodhpur
Saikia Prabal 2024 . Bird Diversity in River Eco-system of Assam In <i>Proc. National Seminar Socio-Economic valuation of Rivers of North East India</i> . 15 March 2024 , Madhabdev University, Assam
Saikia Prabal 2024 . Avifaunal Diversity in Aquaculture. In <i>Proc. National seminar Socio-Economic Issues and Status of Fishermen of Subansiri river, Assam: Policy Drafting for Livelihood Enhancement</i> . ICSSR 28-29 June 2024, Silapathar Science College, Assam
Borkotoki, Bikram & Ozha, Bibha & Saikia, Prabal & Sharma, Kishore & Sarma, Pallab. (2025). Need-Based Nitrogen Fertilizer Management using Leaf Colour Chart in Rainfed Winter Rice to Improve Nitrogen Use Efficiency and Yield. Indian Journal of Dryland Agricultural Research and Development. 12-16
Borah, C & Borah, Ratul & Saikia, Prabal & Phukon, Mousumi & Neog, Borsha & Borgohain, Arundhati & Reddy, Chaduvula & Mudoi, Abhilisa & Mondal, Sayan. (2025). Depredatory Birds and their Damage Assessment in Rice Ecosystem, India. Ecology, Environment and Conservation. 31. S213-S217.
Hazarika, Tanbir & Saikia, Prabal & Phukan, Bithika. (2026). Impact of the Invasion of the Rhesus Monkey in Muga Cultivation Area: A Case Study in the Dhakuakhana Sub-division of Lakhimpur District of Assam. International Journal of Environment and Climate Change. 16. 297-304.

Technical & Extension bulletins/folders etc.

2015	Nest boxes for the Barn owl : A Breeding Success
2015	Rose- ringed Parakeet : Damage and eco friendly management in Agriculture
2016	Checklist of Birds of <i>Dakshinpat Satra</i> in Majuli, Assam
2016	Rat management through Barn owl
2018	Birds of economic importance in agricultural landscape of Assam
2018	Residential birds of Assam and conservation strategies
2020	Management of depredatory birds
2022	Biodiversity at AAU-ZRS, North Lakhimpur – Green Audit
2023	Agri-Solar: Ecofriendly Monkey Management Strategy in Crop Field
2025	Red Bao Rice of Assam.
2025	HYV of DWR & Buckwheat Technical bulletin
2025	Characteristics of niger crop and its scientific cultivation in Assam.
2025	Deepwater rice in Assamease.

Book chapter

Saikia Prabal.(2016). Winged Beauty of Assam. In <i>Eastern bugle</i> - A Souvenir 76 th Annual Conference of Indian Society of Agricultural Economics, AAU, Jorhat , 21-23 November, 2016.Pp 56-58
Saikia Prabal . (2018). Pest Management in Organic Cultivation through Predatory Birds. In <i>Compendium Book</i> .ICAR sponsored 21 days National level training on “Recent development in organic production systems” 7-27 Feb 2018, Centre for Advanced Faculty Training (CAFT), AAU, Pp235
Saikia Prabal . (2019). Spider as Bio control Agent in Organic Farming: a case study in Rice Agro ecosystems of Assam. In <i>Organic agriculture and Soil health</i> , , Centre for Advanced Faculty Training (CAFT), AAU.Pp303
Sarma, P.K.; Barua, N.; Borah, R.; Sonowal, A.; Kalita, R.; Neog, P; Saikia, Prabal and Gogoi, N.(2022). Adaptation Strategies for Climate Variability in the High Rainfall Zone of India. In : <i>Climate change-Recent Observations</i> , Epule, T.E.; Epule, D.; (Eds), Intechopen,DOI: HTTP://dx.doi.org/10.5772/intechopen.107045 , pp 1-24, ISBN:DO.
Saikia Prabal (2023). Bird check list of Assam Agricultural University, Jorhat campus. In <i>Rambling in and around AAU, Jorhat</i> , B.K Sarmah and M.V Deshpande (Ed), DBT-NE Centre for Agricultural Biotecnology, AAU, Jorhat
Saikia, Prabal (2023). Diverse Birds of North East India. in : <i>Sustainable Use of Bioresearches in North East India</i> , Das, R.; Patgiri, P.; Deka, B.; Sarmah, A.K.; (Eds), College of Agriculture, Jorhat, Assam Agricultural University, Jorhat, Assam, pp 193-202, ISBN:978-81-963002-3-4.
Saikia, Prabal (2023). Role of Insectivorous Birds in IPM. In <i>Souvenir Book</i> , Centenary year of AAU- Assam Rice Research Station, Titabar , Assam, S.K Chetia (Ed) pp.79-83
Das, Yater & Saikia, Prabal & Sharma, Kishore. (2025). Plant Genetic Resources : A Need for Sustainable Food Security Chapter -03.
Hazarika, Tanbir & Saikia, Prabal. (2025). Population Distribution of Rhesus Macaque and its Impact on Agricultural Crops in Lakhimpur District of Assam Chapter -10.

BOOK

1. Saikia, P. (2022). *Samaj Sahitya Bigyan*. (Science & Society.) North Lakhimpur College(Autonomous) Publications, North Lakhimpur, ISBN:978-81-956154-4-5

2. Saikia, P. (2022). *ENTOMOLOGY: AN INTRODUCTION*. North Lakhimpur College(Autonomous) Publications, North Lakhimpur, Assam, ISBN:978-81-956154-5-2
3. SAIKIA, P. (2020). *Aamar Parivesh*.(Our Environment) NATURE’S BECKON, Dhubri, Assam
4. SAIKIA, P. (2019). *Aamar Gaonphura Coraibur*. (Birds of countryside)NATURE’S BECKON, Dhubri, Assam, ISBN:978-81-936466-8-7
5. Saikia,P.,Gogoi,N.(2024).Insect Pest and Diseaes of Deep Water Rice.AAU- ZONAL RESEARCH STATION, NORTH LAKHIMPUR, ASSAM AGRICULTURAL UNIVERSITY. AAU/DR/17(BU)/237/2018-19

Conference paper

Year	Title
2024	<u>Safety evaluation and monitoring of pesticides in agricultural commodities</u>
2024	<u>Diversity of spider in rice ecosystem in lakhimpur district</u>
2024	<u>Bird Diversity in Agricultural landscape of Northern Assam</u>
2024	Identification of rodents and insectivore prey species in the diet of barn owl , tyota alba by pellet analysis
2024	<u>Predatory spiders associated with sali rice eco-system in sonitpur district of asaam</u>
2024	<u>Effect of ipm on predatory fauna of rice ecosystem</u>
2024	<u>Mainstreaming good practices of on-farm Agro-biodiversity Management in Lakhimpur district of Assam -lesson learned</u>
2024	<u>Effect of moisture stress on soil nutrient availability and yield performance of late sown toria in acid soils</u>
2024	<u>Species Composition, Abundance and Seasonal Fluctuation of Sparrow Population in Assam</u>
2024	<u>Reproductive cycle of Barn Owl Tyto alba in artificial nest box and diet analysis in agro-ecosystem of Assam</u>
2024	<u>Bird Diversity in Agricultural Landscapes of Majuli River Island, Assam</u>
2024	<u>Impact of weather on behavioral changes of water bird – a case study in satajan wetland of northern assam</u>
2024	<u>Bari system of assam as repository of bird diversity</u>
2024	<u>Impact of improved production technology of mustard (Brassica juncea) in Dhemaji district of Assam through Frontline Demonstrations</u>
2024	<u>Heronry Inhabitants of Bamboo grove in Homestead garden</u>
2024	<u>Avian Community of Aquaculture in Flood Prone Lakhimpur District</u>
2024	<u>Enemy birds of muga silkworm Antheraea assama</u>
2024	<u>Bird Conservation in Agricultural Landscape of Assam and Pest Management on Organic Farming System Prabal Saikia</u>
2024	<u>Species Composition, Abundance and Seasonal Fluctuation of Sparrow Population in Assam</u>

2024	<u>Reproductive cycle of Barn Owl Tyto alba in artificial nest box and diet analysis in agro-ecosystem of Assam</u>
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2024	<u>Avian Community of Aquaculture in Flood Prone Lakhimpur District</u>
2024	<u>Bird Conservation in Agricultural Landscape of Assam and Pest Management on Organic Farming System Prabal Saikia</u>
2023	Bird diversity in agricultural landscape and Role of predatory birds in Natural pest control
2023	Role of Insectivorous Birds in IPM Approach
2025	Study on Lepidoptera and Hymenoptera insect population in agro eco - system at Lakhimpur district of Assam.
2025	Unravelling genetic diversity in climate resilient Baodhan (Deepwater rice) of Assam through DUS morphological characterization.
2025	Monitoring of insect pest population through light trap in rice eco-system.
2025	Role of Birds in diversified Organic & Natural Farming ecosystem.
2025	Diversity of Pest- Predator complex in different growth stages of Toria & Mustard field.
2025	Evaluation of different sticky traps for surveillance of mustard aphid (Lipaphis erysimi).
2025	Habitat analysis and distribution study of Beneficial and depredatory birds in Agro-ecosystem.

Technology Details and its impact:

	Technology no.1	Inventory Details
1	Name of technology	T-perch as roosting sites for predatory insectivorous birds in rice field as a component of IPM
2	Source of technology	ICAR-AINP on Agricultural Ornithology ,RARS, N.Lakhimpur
3	Year of release	2019 POP AAU- Govt of Assam
4	Agro-climatic zone	All Agro-climatic zones of Assam
5	Detail description of technology	Installations of bird perches made of either bamboo or tree branch in the T-shape @ 50/ha with a minimum height of 60cm (2 feet) above crop canopy as a component of IPM to increase the activity of insectivorous birds and reduce the insect population in the rice field.
6	Critical inputs required	T-shaped Wooden or bamboo perches
	Scientist involved	Dr .Prabal Saikia
	Technology no.2	
1	Name of technology	Bird management in Maize

2	Source of technology	ICAR-AINP on Agril Ornithology,RARS, North Lakhimpur
3	Year of release	2019 (Package of practices for selected crops of Assam, APART , AAU -GoA)
4	Agro-climatic zone	All Agro-climatic zones of Assam
5	Detail description of technology	Maize cobs can be protected from granivorous bird damage by covering the cobs at vulnerable grain maturity stage by wrapping cobs with adjacent leaves of the same plant on outer 3 rows on border of the field. Shinning Reflective ribbon strips 1 feet above the crop canopy level in North South direction with twisting to reflect the sunlight throughout the day can also be used to have better protection
6	Critical inputs required	Reflective ribbon
	Scientist involved	Dr .Prabal Saikia
	Technology no.3	
1	Name of the Technology	Depredatory Bird management in Rice
2	Source of technology	ICAR-AINP on Agricultural Ornithology,RARS, N. Lakhimpur
3	Year of release	2019 (Package of practices for selected crops of Assam, APART , AAU- GoA)
4	Agro-climatic zone	All Agro-climatic zones of Assam
5	Detail description of technology	Reflective ribbon of 1.5 cm width , 10 to 15 m long are fixed parallel to the crop above the ground using bamboo poles and strings. During the sunshine the reflection of sunlight and humming noise produced by the wind vibration of the strips scares the birds from crop field. The method caused significant reduction in damage caused by granivorous bird like Munia and Baya weaver
6	Critical input required	Reflective ribbon
	Scientist involved	Dr. Prabal Saikia
	Technology no.4	
1	Name of technology	Rodent control by Barn owl breeding in artificial nest box
2	Source of technology	ICAR-AINP on Agril Ornithology, RARS, N.Lakhimpur
3	Year of release	2021 POP (AAU- Govt. of Assam)
4	Agro-climatic zone	All Agro-climatic zones of Assam
5	Detail description of technology	New technology. Effective, eco-friendly, low cost and easy to use to manage rodent problem in organic agriculture where rodent is abundant but lack of breeding sites for barn owl.
6	Critical inputs required	Plywood/Wooden box for Barn owl
	Scientist involved	Dr.Prabal Saikia
	Technology no.5	
1	Name of technology	Agri-Solar Fencing
2	Source of technology	ICAR-AINP on Agril Ornithology, RARS, N.Lakhimpur
3	Year of release	2024
4	Agro-climatic zone	All Agro-climatic zones of Assam

5	Detail description of technology	Crops grown inside the solar fencing (<i>AGRI-SOLAR</i>) ; a potential method to reduce the problem of intrusion by higher vertebrates (Monkey) into the agricultural landscape gave significantly higher yield as compared to crop yields recorded in the same plot without solar fencing in the previous year. The Agri Solar Energizer uses 12 V input solar energy, generate electrical shock to the higher vertebrates. The shock from an electric fence causes no physical damage to animals and human beings
	Scientist involved	Dr. Prabal Saikia
	Technology no.6	
1	Name of technology	HDPE nylon net to minimize wild Animals Menace in Crop Fields
2	Source of technology	ICAR-AINP on VPM , RARS, N.Lakhimpur
3	Year of release	2025-26 POP (AAU- Govt. of Assam)
4	Agro-climatic zone	All Agro-climatic zones of Assam
5	Detail description of technology	HDPE Nylon Net- , UV Stabilized 5cm mesh and 1.5 mm thick. Net is fixed vertically using bamboo or wooden poles of about 3 meters (9feet) in height, and the net is then spread to about 60 cm horizontally over the ground by using small wooden pegs. If monkey enters, it will be entangled and give out alarm calls that deter other monkeys.
6	Critical inputs required	HDPE net and bamboo
7	Scientist involved	Prabal Saikia

Famers Sensitization on VPM



Farmers Participatory Adaptive Research on VPM



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