

**LAND-USE CHANGE PATTERN AND BIRD DIVERSITY OF  
PULIYAMPULLY WATERSHED, MUNDUR GRAMA  
PANCHAYATH, PALAKKAD, KERALA**



**Rajeshkumar, N\*, Manimekalan, A. and Arun Kumar, A.A.**

Department of Environmental Sciences, Bharathiar University, Coimbatore-641046, Tamil Nadu, India

\*Email: rajesh.kumar221991@gmail.com

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**Abstract:** Birds are the important components of our ecosystem and play a major role in maintaining the natural balance of food chain. Birds are excellent indicators of environmental health and their changing populations often provide clues to the health of their habitats. Paddy fields are the main food source for the bird community, it should conserve for future generation in a sustainable manner. Land use changes in Kerala were un-presented during the past half century. A substantial decline in the area under rice cultivation, besides a drastic increase in coconut and rubber cultivation is paramount in this respect. Changes in land-use and land cover will be continued to be affected in terms of the biological diversity worldwide. Paddy field is a type of wetland ecosystem where major bird species utilize them as food resources and water. Predatory cultivation like inorganic pesticides application and harvesting season changes has affected the natural activity of resident bird species in the paddy fields. The present study was carried out in Puliampully watershed located 10°50'11" to 10°52'07"N latitude and 76°32'22" to 76°34'49"E longitude, from December 2012 to April 2013. An average elevation is 80 meter to 140 meter from Mean Sea Level (MSL). Data was noted in the morning (7.00 am to 10.00 am) and sometimes in the evening (4.00 pm to 6.00 pm). This study focus on the purpose of identifying, conserving the indicator species of avian community and land-use changes of paddy fields in the Puliampully watershed, Kerala. The total count (Urfi *et al.*, 2005) method was used to assess the bird population, which suitable for paddy and rubber field. All total count made with direct eye visual method by using binoculars, observer walked over all parts of the field to make a count of all birds' activity areas. Birds depend on paddy field as the main source for food, nesting and breeding during the period of South West and North East monsoon. Based on my present survey, 165,505 hectares of paddy fields has decreased into 93,150 hectares, such as rubber plantations in the Puliampully watershed and also 72,355 hectares in Palakkad district of Kerala from 2006 to 2013. Land-use changes and the pesticide application in the agricultural land play a key role in the declining of bird species, which is a negative sign to the depletion of biodiversity. Demand status of money for day to day life has over-involved in satisfying the needs for the growing human population. Totally 698 individuals of birds were recorded in the rubber field. Among the birds the maximum number of individuals were recorded include Jungle babbler *Turdoides striata* (n=167) followed by Cattle Egret *Bubulcus ibis* (n=160) and Bronzed drongo *Dicrurus aeneus* (n=62), which are appear to be the major dominant bird species in the rubber field. Some bird species were occurred very least numbers in the rubber field such as Indian peafowl, Common iora, Red whiskered bulbul, Asian paradise flycatcher, golden fronted leaf bird. As well as in the paddy field 3362 individuals of birds have been enumerated. Maximum number of individuals were recorded for Common swallow *Hirundo rustica* (n= 462) followed by Jungle babbler *Turdoides striata* (n=306) and Cattle egret *Bubulcus ibis* (n=267). Two bird species viz., little cormorant and yellow wagtail showed very low number of individuals. When we compared the paddy and rubber field bird population, paddy indicates they are the important ecological source for birds, fish, frog, insects and plants including human. It may possible to change the balance of paddy fields in future due to climate change, ground water reducing, conversion of paddy field into rubber field and pesticide contamination. Those above mentioned factors will be leads to the loss of ecological biodiversity in the paddy field.

**Key words:** Land-use change, Bird diversity, Paddy fields, Ecological balance, Ground water, Declining of resident birds, Conservation.

## INTRODUCTION

Agricultural land-use changes in Kerala during the past half-century were marked by an initial increase in total cropped area (26% between 1960 and 1969). For example, rice area dropped by 60% between 1975 and 2003, while the cultivation of

coconut, rubber, areca nut and banana plantains increased spectacularly into 106, 627, 41 actors (96%) respectively between 1955 and 2000). As mono specific cultivation methods became extensive and the live fences scattered trees on

farmlands were decimated, the capacity within the agricultural sector to meet its own demands (green manure, poles, fodder, firewood and timber) also reduced, which in turn, increased the dependent on forest lands (Kumar, 2005). In the past decades there was no record for bird species data and their populations in agricultural fields in Mundur grama Panchayath, Palakkad district of Kerala. Mundur grama Panchayath has seven watersheds namely Chalakal, Poriyani, Chembakkara, Vazhukka Para, SatramKavu, Pulikkotupara and Puliampully. According to the Mundur Grama Panchayath watershed development plan-2012, paddy is the main food source for the livelihood of peoples. Now a day paddy fields are converted into rubber plantations due to insufficient balance of ground water, low rainfall and economical reasons.

Based on the land-use report rubber plantation land-use is increased two times than the paddy cultivation, based on the Mundur Grama Panchayath watershed development master plan-2012 and questionnaire survey showed this result in my study area. The present generation has changed from paddy cultivation to rubber plantation which indicates that they are money minded.

Through the questionnaire survey, I have collected primary data regarding land-use changes about farming types and pesticides application to the paddy fields. In this study, I am focused on more about bird species richness, which has been declining due to the vast and fast changes in land-use category, usages of pesticide to paddy fields and also other farmlands types in my study area. Hereby, I made attempt on the inorganic farming methods which are being harmful to environment and biological diversity, particularly in avian communities and humans. This type of farming leads to declining of huge number of birds through affect their breeding, laying and hatching of eggs. Land-use changes and agricultural intensification, affected the biodiversity of managed landscapes. Indeed, a large proportion of the Kerala home gardens have been converted into small-scale plantations of coconut and rubber or cropping systems

consisting of fewer crops due to commercialization and fragmentation of land holdings (Kumar and Nair, 2004).

This study focus on the purpose of identifying, conserving the indicator species of avian community and land-use changes of paddy fields in the Puliampully watershed, Kerala. Which helps to create awareness for the local people and land owners regarding with how the organic farming is important for our present and future generation such as, land-use patterns, eco-friendly management of farmlands, health effects of pesticides and also its toxicity to environment.

## MATERIALS AND METHODS

### Study area

The present study was carried out in Puliampully watershed located 10°50'11" to 10°52'07"N latitude and 76°32'22" to 76°34'49"E longitude at Mundur grama panchayath in Palakkad district of Kerala with an average elevation of 80 m to 140 meters from Mean Sea Level (MSL) (Fig. 1 & 2). This study has taken into five months from December 2012 to April 2013. The study area surrounded by four major parts such as, North: Mundur - Mannarkkad Road, South: Cheripuzhacheri - Palakkad road, east: Kotakkunnu, North: Kogand Grama Panchayath. Puliampully watershed has three types of soil namely sand mixed red soil, laterite soil and sand mixed mud soil. An average temperature 19.25°C to 39.25°C has been recorded during the study period. Maximum rainfall is 76.5 mm and the total 1518.5 mm. Number of rainy days (December 2012 to April 2013) were 115 and the average humidity was 78 % in our study area.

The total count (Urfi *et al.*, 2005) method was carried out to enumerate the bird population in the Puliampully watershed. We have taken 20 acres of Paddy and 20 acres of Rubber filed to enumerate the bird population and identifying the land use pattern. This total count method was conducted between morning 7.00 AM to 10.00 AM and evening 4.00 to 6.00 PM, which is the active time for birds. Birds were monitored by using binoculars and the observer walked over all parts of the field to make a count of all birds present.

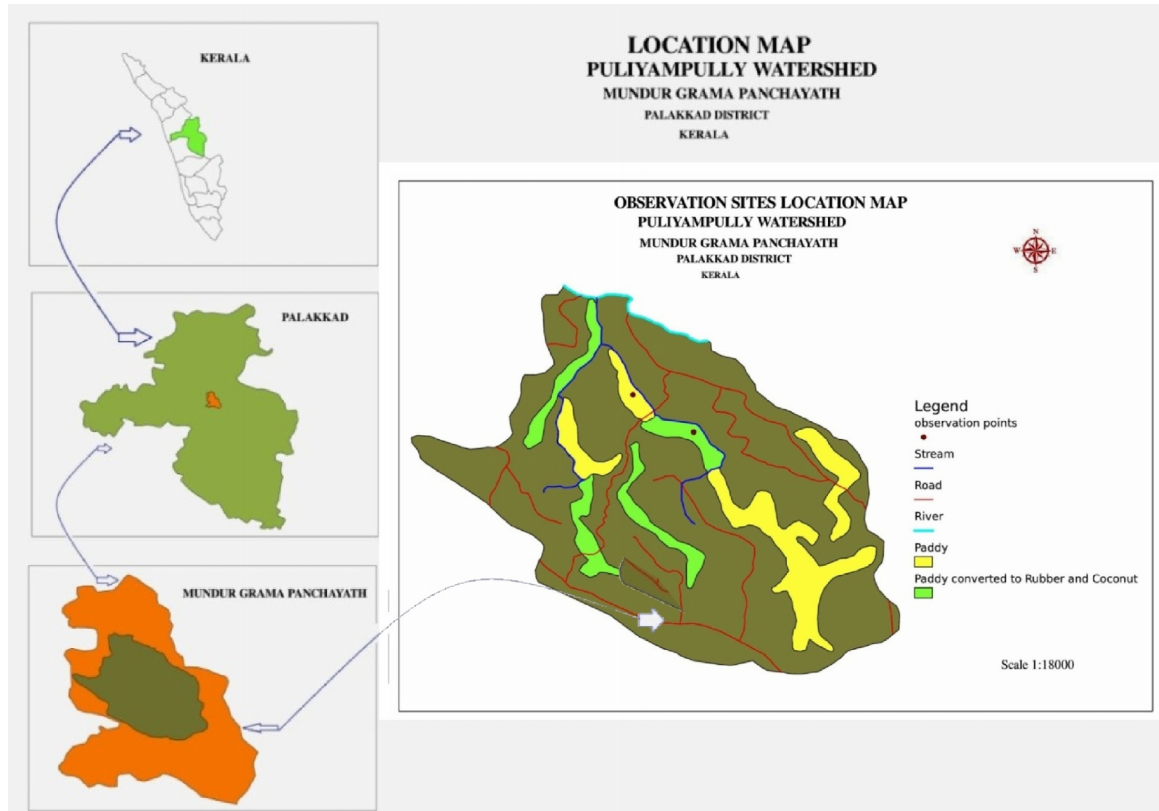


Fig. 1. Location map of the Puliampully watershed

Birds were identified with the help of different field guides (Salim Ali, 1996; Ananda Banerjee, 2010; Ranjit Manakandan *et al.*, 2011; Richard Grimmett and Tim Inskipp, 2007, Richard Grimmett *et al.*, 1999).

### Equipments need

1 × pair binoculars (Nikon-7×35mm), 1 × pair ears and eyes, 1 × SLR camera (Canon EOS 1000D-8×55mm lens) – for capture the birds in the field, Global Positioning System.

### Questionnaire survey

To meet the local people directly to collect the data such as influence of land-use changes, pesticides application to paddy field usage, its types, different farming types and reasons for converting paddy field into other plantations like rubber, coconut.

Secondary data's are collected from international publications from different sources of websites and books and semi official publications from

Mundur grama panchayath and Integrated Rural Technology Centre, Palakkad, Kerala. Watershed map has been prepared from watershed atlas at the scale of 1:50000, which prepared by Kerala State Land use Board, Soil Survey Department and Remote Sensing Departments of Kerala. Spatial maps had collected from GIS open source software like Quantum GIS 1.7 version and GRASS GIS 6.4 version.

### RESULTS AND DISCUSSION

#### Land-use change pattern Puliampully watershed

Paddy is the main food source for humans and many bird species in India. Usually most of the birds are visits to paddy fields for foraging, nesting and breeding during the period of growing stages of paddy and its harvesting stage. But now the paddy fields are changed in the Puliampully watershed (more than 72.355 hectares) and also bird species population has started to declining due to scanty food sources



**Fig. 2 a & b.** Major landuse in the study area

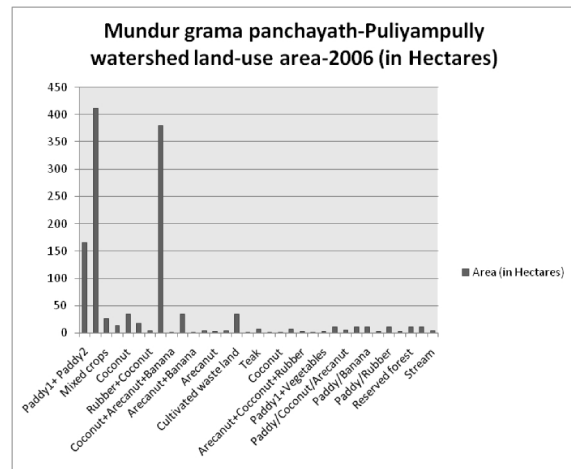
and conversion of paddy fields into coconut, rubber plantations etc (Fig. 2 a & b).. According to the current report by this study, 165.505 hectares of paddy fields are decreased to 93.150 hectares and the changed area is 72.355 hectares in 2006 to 2013 (Table 1; Fig. 3 & 4)..

Two major reasons such as land-use changes, the pesticides usages in the agricultural land, which are the major motivation for the declining of bird species. Land use is known to be a key driver of biodiversity change and intense habitat alteration also contributed to the disappearance of many species of birds. The food production need of the growing human population is the most important indicator for land-use changes.

Due to insufficient balance of ground water, low rainfall, low production of rice, less man power for paddy cultivation and other purpose, which of these are major reasons for conversion of paddy into rubber plantation by people. Based on above reasons, which were influence the fond of rubber plantation, because peoples can earn more money from rubber tapping and it also saves their time. Above mentioned information were collected from land owners through questionnaire survey. Grazing has decreased due to above mentioned reasons and this also indicated the declining pattern of bird species in the paddy field especially for egrets. This will affect the ecological balance and the foraging habitats of birds.

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**Fig. 3.** Bar chart showing the land use area of Puliyampully watershed during 2006.

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**Table 1.** Land use pattern details of Puliayampully watershed, Palakkad

No	Land-use crops of Puliayampully watershed	Area (in Hectares)
1	Paddy <sub>1</sub> + Paddy <sub>2</sub>	165.505
2	Rubber	411.633
3	Mixed crops	26.27
4	Rubber+Mixed trees	13.69
5	Coconut	33.82
6	Coconut+Mixed trees	18.109
7	Rubber+Coconut	3.625
8	Mixed trees	380.135
9	Coconut+Arecanut+Banana	1.125
10	Coconut+Arecanut	34.445
11	Arecanut+Banana	1.25
12	Coconut+Banana	3.69
13	Arecanut	2.57
14	Banana	4.2
15	Cultivated waste land	34
16	Play Ground	1.5
17	Teak	6.07
18	Uncultivated waste land	1.5
19	Coconut	1.125
20	Coconut+Pepper	6
21	Arecanut+Coconut+Rubber	1.94
22	Arecanut+Rubber	1
23	Paddy <sub>1</sub> +Vegetables	2
24	Paddy/Coconut	11.19
25	Paddy/Coconut/Arecanut	5.125
26	Paddy/Arecanut	10.76
27	Paddy/Banana	11.25
28	Paddy/Coconut+Arecanut+Banana	2.19
29	Paddy/Rubber	10.2
30	Paddy/Coconut+Banana	1.875
31	Reserved forest	11
32	Road	11.07
33	Stream	4
<b>Land use of total area (in Hectares)</b>		<b>1233.862</b>

were collected from land owners through questionnaire survey. Grazing has decreased due to above mentioned reasons and this also indicated the declining pattern of bird species in the paddy field especially for egrets. This will affect the ecological balance and the foraging habitats of birds.

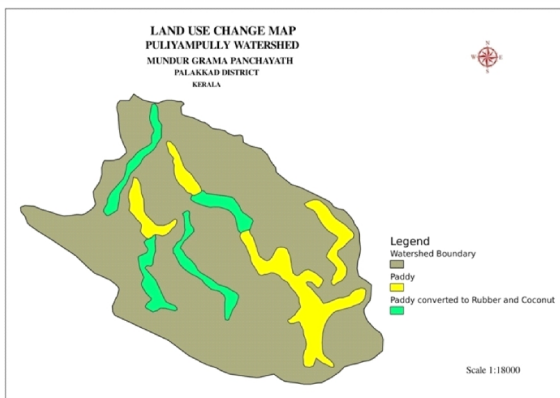
During our study a total of 3362 individuals of birds belonging to 55 species were recorded in the Paddy field (Table 2). Among the bird spe-

cies highest number of individuals were recorded for Common Swallow (n=462) followed by Jungle Babbler (n=306) and Cattle Egret (n=267). Whereas in the Rubber field have 698 individuals belonging 33 species of birds were recorded. Maximum number of bird individuals were include Jungle Babbler (n=167) followed by Cattle Egret (n= 160) and Bronzed drongo (n=62). This study showed the paddy is having large number of bird species individuals than the rubber field in Puliayampully watershed

**Table 3:** Bird abundance and percentage values of individual species in Rubber field (SITE 2)

No	Common Name of the Bird Species	Family of Bird species	Scientific Name	Bird Abundance	%
1	Common swallow	Hirundinidae	<i>Hirundo rustica</i>	462	13.74
2	Jungle babbler	Timalidae	<i>Turdoides striata</i>	306	9.1
3	Cattle egret	Ardeidae	<i>Bubulcus ibis</i>	267	7.94
4	Indian pond heron	Ardeidae	<i>Ardeola grayii</i>	243	7.23
5	White-rumped munia	Esrrildidae	<i>Lonchura striata</i>	236	7.02
6	House crow	Corvidae	<i>Corvus splendens</i>	233	6.93
7	Common myna	Sturnidae	<i>Acridotheres tristis</i>	164	4.88
8	Plume headed parakeet	Psittacidae	<i>Psittacula cyanocephala</i>	141	4.19
9	Paddy field pipit	Motacillidae	<i>Anthus rufulus</i>	88	2.62
10	Spotted dove	Columbidae	<i>Spilopelia chinensis</i>	79	2.35
11	Bronzed drongo	Dicruridae	<i>Dicrurus aeneus</i>	77	2.29
12	Rose ringed parakeet	Psittacidae	<i>Psittacula krameri</i>	75	2.23
13	Indian peafowl	Phasianidae	<i>Pavo cristatus</i>	68	2.02
14	Green bee-eater	Meropidae	<i>Merops orientalis</i>	67	1.99
15	Rufous treepie	Corvidae	<i>Dendrocitta vagabunda</i>	66	1.96
16	Common babbler	Timalidae	<i>Turdoides caudate</i>	60	1.78
17	White-throated kingfisher	Alcedinidae	<i>Halcyon smyrnensis</i>	43	1.28
18	Rosy starling	Sturnidae	<i>Sturnus roseus</i>	43	1.28
19	Yellow-eyed babbler	Timalidae	<i>Chrysomma sinense</i>	41	1.22
20	Red whiskered bulbul	Pycnonotidae	<i>Pycnonotus jocosus</i>	40	1.19
21	White cheeked barbet	Capitonidae	<i>Megalaima zeylanica</i>	39	1.16
22	Black kite	Accipitridae	<i>Milvus migrans</i>	38	1.13
23	Black hooded oriole	Oriolidae	<i>Oriolus xanthornus</i>	35	1.04
24	Red vented bulbul	Pycnonotidae	<i>Pycnonotus cafer</i>	34	1.01
25	Greater cocual	Cuculidae	<i>Centropus sinensis</i>	33	0.98
26	Asian koel	Cuculidae	<i>Eudynamys scolopaceus</i>	32	0.95
27	Brahminy kite	Accipitridae	<i>Haliastur Indus</i>	29	0.86
28	Common tailor bird	Cisticolidae	<i>Orthotomus sutorius</i>	28	0.83
29	Blue-rock pigeon	Columbidae	<i>Columba livia</i>	24	0.71
30	Stork billed kingfisher	Alcedinidae	<i>Pelargopsis capensis</i>	23	0.68
31	Red-wattled lapwing	Charadriidae	<i>Vanellus indicus</i>	21	0.62
32	Laughing dove	Alcedinidae	<i>Spilopelia senegalensis</i>	21	0.62
33	Large billed crow	Corvidae	<i>Corvus macrorhynchos</i>	17	0.51
34	Common rosefinch	Fringillidae	<i>Carpodacus erythrinus</i>	16	0.48
35	Greater Racket-tailed Drongo	Dicruridae	<i>Dicrurus paradiseus</i>	14	0.42
36	White-breasted water hen	Rallidae	<i>Amaurornis phoenicurus</i>	14	0.42

37	Purple-rumped sunbird	Nectariniidae	<i>Leptocoma zeylonica</i>	14	0.42
38	Oriental magpie robin	Muscicapidae	<i>Copsychus saularis</i>	11	0.33
39	Chestnut headed bee-eater	Meropidae	<i>Merops leschenaultia</i>	11	0.33
40	Common kingfisher	Alcedinidae	<i>Alcedo atthis</i>	10	0.3
41	Purple sunbird	Nectariniidae	<i>Cinnyris asiaticus</i>	10	0.3
42	Common-hawk cuckoo	Cuculidae	<i>Hierococcyx varius</i>	10	0.3
43	Indian silver bill	Estrildidae	<i>Euodice malabarica</i>	10	0.3
44	Common iora	Aegithinidae	<i>Aegithina tiphia</i>	10	0.3
45	Eurasian golden oriole	Oriolidae	<i>Oriolus oriolus</i>	9	0.27
46	Scaly-breasted munia	Esrrildidae	<i>Lonchura punctulata</i>	8	0.24
47	Indian grey hornbill	Bucerotidae	<i>Ocyrceros birostris</i>	8	0.24
48	Indian roller	Coraciidae	<i>Coracias benghalensis</i>	8	0.24
49	Baya weaver	Ploceidae	<i>Ploceus philippinus</i>	8	0.24
50	Asian paradise flycatcher	Monarchidae	<i>Terpsiphone paradise</i>	5	0.15
51	Golden fronted leaf bird	Chloropseidae	<i>Chloropsis aurifrons</i>	4	0.12
52	Common hoopoe	Upupidae	<i>Upupa epops</i>	3	0.09
53	Greater flameback	Picidae	<i>Dinopium benghalense</i>	2	0.06
54	Little cormorant	Phalacrocoracidae	<i>Phalacrocorax niger</i>	2	0.06
55	Yellow wagtail	Motacillidae	<i>Motacilla flava</i>	2	0.06
				3362	100



**Fig. 4.** Map shows the converted land-use of paddy and rubber from 2006 to 2013

(Table 3). We have categorized the bird species into many guilds like Carnivorous, Insectivores, Granivores, and Frugivorous. Spotted dove (*Spilopelia chinensis*), laughing dove (*Spilopelia senegalensis*), Indian peafowl (*Pavo cristatus*), yellow eyed babbler (*Chrysomma sinense*), baya weaver (*Ploceus philippinus*), white rumped munia (*Lonchura striata*) and scaly breasted munia (*Lonchura punctulata*) these are the bird families coming under the category of Granivores, because they have feed on paddy for their survival in the paddy field.

Insectivorous or Omnivorous bird species like Cattle egrets *Bubulcus ibis*, Indian Pond heron *Ardeola grayii*, Green bee-eater *Merops orientalis*, plume headed parakeet *Psittacula cyanocephala*, rose ringed parakeet *Psittacula krameri*, black drongo *Dicrurus macrocerus*, greater racket tailed drongo *Dicrurus paradiseus*, white throated kingfisher *Halcyon smyrnensis*, Stork billed kingfisher *Pelargopsis capensis*, oriental magpie robin *Copsychus saularis*, paddy field pipit *Anthus rufulus*, house crow *Corvus splendens* and Common myna *Acridotheres tristis* these are the birds which are highly beneficial for the agriculture management. Those bird species helps to eradicate the soil insects and pupae at the time of ploughing (initial cultivation), during cultivation and after harvesting period for people.

White rumped munia is the bird species flocking and searching their food in the paddy field with subspecies of scaly-breasted munia which is sharing their roosting habitat in the bamboo trees. Then the rubber plantations are the best nesting places for drongo species. I was noted the observation of Bronzed drongo was making a nest during the study period in a rubber tree on March.

An interesting finding is plume headed parakeets and also the rose ringed parakeets are flocks together in groups from 10 - 25 birds which are for foraging their habitats in paddy fields. Basically birds are natural pest controller in the agricultural fields especially for paddy field. I was noted the chemical pesticides (fenvelarate) applied to the paddy fields to control the insects which is poisonous will be kill the insects, host plants of some butterflies. Then that harmful chemical will be added to soil and water through paddy plant root.

## DISCUSSION

Paddy fields were a major and main foraging habitat for egrets and paddy birds (Vijayan, 1986). According to the Bhalodia *et al.* (1997), many species of birds recognized beneficial to crops by playing an important role in the biological control of pests. Egrets close to the standing crop, the insects harbored on rice plants are flushed which in turn form the food for these birds.

The house crow (*Corvus splendens*) and the common myna, *Acridotheres tristis* are highly beneficial to agriculturists as they help to eradicate the soil insects and pupae at the time of the ploughing, during and after harvest. The kingfisher especially, *Halcyon smyrensis*, commonly noted in rice fields n their predatory habit on insets (Nathan and Rajendran, 1981). It has been observed that the food preference of roller, oriental magpie robin and house crow is grasshoppers, crickets, weevils, caterpillars, frogs and lizards, other grasshoppers, prawn and fish as that of pond heron, dipterans, the chief of swallows, oxa sp., crickets, bugs, weevils, beetles, paddy stem bores and rice bug as the food of common myna, plume headed parakeet, hose crow, black drongo feed on some butterflies species also.

Flocking is a survival of anti-predator device and birds prefer the field for a source and availability of food. Paddy field provides suitable habitat conditions for resident birds, water birds and migratory birds also. The availability of different prey in paddy field is dependent on the availability of suitable field conditions, which in turn resulted in the concentration of specific type of birds to specific field conditions. When the plot is being ploughed, puddles or leveled,

the prey supply is continuously held at maximum exposes soil organisms and that attract many ground foraging birds to the site.

Sturdidae family of Rosy starling *Sturnus roseus* is a bird and also common winter visitor to the paddy fields of south India. It's flocking on fruiting, flowering trees and fighting with Common myna *Acridotheres tristis* for their food habitats. Rosy starling is also invaders species and it's preventing their habitat from other enemies. It is interesting to note that only 25 out of 1200 species of birds found in India, (2.5 percent) have been reported to inflict damage to crops (Dhindsa and Saini, 1994). Baya weaver *Ploceus phillipinus* birds are known to be important bird pest of rice damaging at nursery stage and from milky to harvesting stage and also survival of nest site selection in coconut and palm trees, behavior is very graceful and attractive in the southwest monsoon seasons of paddy fields of Kerala.

## Pesticides uses in Paddy field

From the questionarrie survey, inorganic farming is the specifice applications were usually applied for all vegetation types in Puliypully watershed. That should be avoided for present and future natural resources, and then we will loss the traditional way of farming. Pesticides products usage concern mostly they use Insecticides like FAME - Fame 180 sc, Epcoban - Chlorypyriphos 20% EC., Cymbush - Cypermethrin 25% EC. Fenval - Fenvalerate 20% EC, HILBAN - Chlorphriphos 20 % E.C., As per the Herbicides concern they mostly use Sweep - Glyphosate 41% S.L, Roundup - Glyphosate 41 % S.L, Liquid pseudomonas fluorescence. Fig. 5 shows some pesticides used and other related activities. The use of insecticides and herbicides and its effects on biodiversity concern mostly they use insecticides for the control of insect sucking pest, chewing insect, caterpillars on paddy, and vegetables crops, control of ball worms and diamond back moth etc. Herbicides are recommended for the control of *Axonopus compressus*, *Cynodon dactylon*, *Imperate cylindrica*, *polygonum perfollinatum*, *Paspalum scrobiculatum*, *Arundinella bengalensis* and *kalm grass*.





**Fig. 5** Pesticide usage in the Paddy fields

From the Paddy fields were major and foraging habitats for egrets and paddy birds and many species of birds are recognized beneficial to crops by playing an important role in the biological control of pests. Birds adapt different feeding techniques because of the presence highly diverse group of prey that occurs in the paddy fields and large majority of birds frequented rice fields for food. Few bird species using all vegetation types, but most were limited by vegetation structure or water presence.

Paddy fields have provided feeds for a lot of winter migratory birds. In addition to the paddy rice providing cereal feeds, areas that migratory birds visit frequently have other ecological conditions like nesting, breeding and shelter place around paddy fields. Besides providing food to more than half of the world's population, rice fields generate other minor produce including fish, medicinal plants, fodder etc. In addition to the economic benefits, rice fields play numerous ecological roles including maintenance of tropic structures, nutrient recycling, ground water recharge and most

importantly harbors diverse floral and faunal communities.

Then the rubber plantation is provide less number of bird species habitat like Brozed drongo nesting places, white cheeched barbet, cattle egret and Jungle babbler. Land-use pattern changes like paddy field converted to rubber plantation its affects the individual bird species population and also reduce the ground water, changes in the breeding patterns of birds and their food resources. Fig 6 shows the visitors to the paddy fileds.

#### **Need for Conservation**

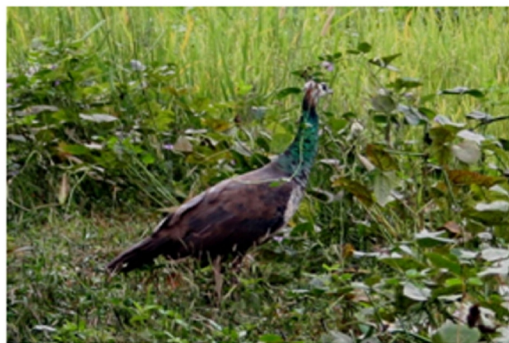
- Increasing the availability of food is to the common strategy to promote bird population growth.
- Reclamation should be avoided.
- Proper drainage system should be maintained.
- Crops rotation should be practiced in traditional way without polluting the nature. Ponds and other streams channels should be maintained.



**Plume headed parakeet flocks**



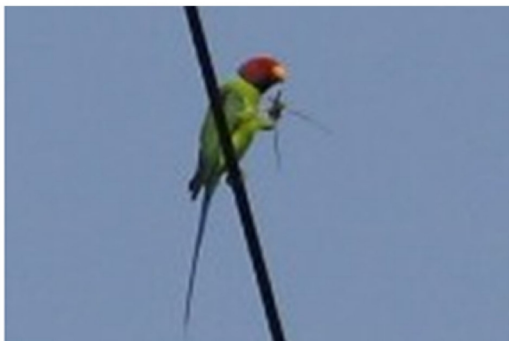
**White rumped munia flocks**



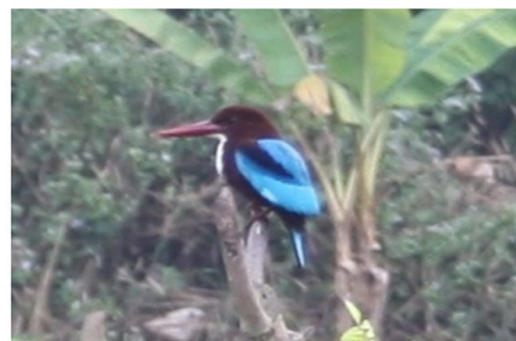
**Indian peafowl**



**Cattle egret flocking**



**Plume headed parakeet**



**White throated kingfisher**

**Fig. 6. Birds found common in the study area**

A key alternative to intensive rice agriculture is the traditional rice-fish farming model, in which the presence of fish and other aquatic fauna in flooded fields helps to control rice pests and decreased the need for pesticide use. Such organisms also aid in nutrient recycling, decreasing need for fertilizer application and producing a more sustainable system conducive to the recovery of soil fertility and the prevention

of soil degradation (Halwart and Gupta 2004). To change the cultivation type to organic farming from chemical farming method, the organic farming method should increases through the proper awareness to the peoples. To provide alter-native technology is need for increase the availability rice cultivation for to improve the economical status of the country.

## CONCLUSIONS

To be concluding, one of the best ways of protecting the bird population is to protect its habitat if habitat is conserved the bird population can be conserved once habitat is destroyed than it will have more negative effect on the bird community including human and other organisms. By protecting the whole biodiversity including all the plants and animals will help to stay the birds in their original habitat. Land-use change is the important environmental issue in Puliampully watershed in the Mundur grama Panchayath, Palakkad district of Kerala. Then the land-use change is a type of habitat destruction for birds in the paddy field when they changed to rubber. Kerala government should take effort for to control the land-use pattern changes of paddy field for conserving the rice bowl. Basically rubber plantation and its productions have increased all other parts of Kerala when we noticed that. To create the awareness to farmland owners to organic farming with traditional methods like rice-fish farming model. To avoid the pesticide use to control the insects in paddy field should be avoided or minimized in a proper way. Conservation of wildlife and nature especially for birds will create the indication of threats including climate change, habitat degradation,

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