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A Study of Bird Inhabitation as Seen in Farmlands in Nishi Ward of Kobe City and the Eastern Part of Akashi City

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Abstract

The authors selected three farmland-containing areas in Nishi Ward of Kobe City and the eastern part of Akashi City for this ecological study to investigate the current situations of bird inhabitation in suburban areas and within the cities.

Through this study, the following results were obtained in terms of bird inhabitation in the rural forest (*Satoyama*) area and in the farming area: 10 orders, 23 families and 35 species; and 9 orders, 20 families and 30 species, respectively. In the urban area, 4 orders, 10 families and 30 species of birds were observed, most of which were city birds. The species and the population number of birds observed in this study along with the diversity index obtained from the observation results revealed that the rural forest and farming areas, located in the vicinity of urban areas, conserve a certain degree of the natural environment required for bird inhabitation, even while experiencing strong effects of urbanization. Although the bird species observed in these areas were different, the diversity of the species and the population number of birds found showed similar values. Therefore, this study suggests that agricultural areas preserve a crucial environment for bird inhabitation, which is equivalent to that of hilly areas.

Study Purpose

Farmlands in suburban areas and those within the cities have been conserved as green zones. Recently these farmlands began rapidly losing their foundation as green zones, as situations surrounding Japanese agriculture and society have been undergoing changes due to the high growth of the Japanese economy. Farmlands and hills, especially, which have greatly contributed to the conservation of the ecological system of small villages, are rapidly decreasing in size.

Therefore, to consider the way to use and conserve our farmlands and hills, it is fundamentally necessary to correctly understand the current status of agricultural areas, based on ecological surveys.

This study, then, is aimed to investigate the current situation of birds living both in suburban areas of Nishi Ward of Kobe City and the eastern part of Akashi City and within the cities themselves. The authors selected three farmland-containing areas in Nishi Ward of Kobe City and the eastern part of Akashi City for this study.

Study Method

1) Selection of the Areas of Study

Farmlands and hills have been rapidly destroyed in Nishi Ward, due to the development of new towns and the establishment of manufacturing facilities. The authors selected two areas from the farming areas in the suburbs of central Kobe, and one from the farmland-dotted areas on the edge of the city. From the farming areas, the following two areas were selected: a hilly area with good natural environment found on the hillsides; and an agricultural area containing numerous large fields. The other area of study is also located in the vicinity of the other two areas.

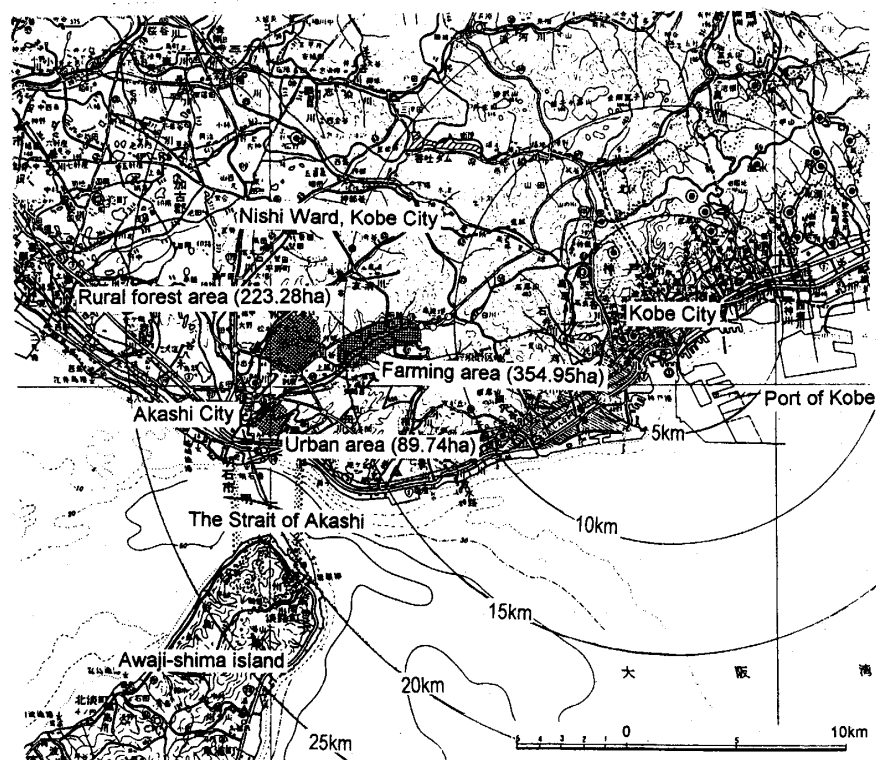


Fig. 1. Map of the study area.

The location of the three areas is shown in Fig.1. The rural forest and farming areas are within approximately 12 to 18 kilometers of the central part of Kobe City, and within roughly 4 to 10 kilometers of the central part of Akashi City. The area with dotted farmlands is located in the east of Akashi City. All the three areas are within a radius of roughly 5 kilometers.

2) Survey and Method of Analysis

2-1) Current status of land use in the areas of study

The current status of land use in the areas of study were analyzed using the GIS (Geographical Information System).

The fundamental data for this study was mainly taken from the 1/30,000 scale vegetation map found in the 1982 report prepared by the Environment Bureau of Kobe City, and was

modified and supplemented using aerial photos taken in June 1991, June 1996 and March 1997 along with field study results obtained in 1994, 1996 and 1997.

First, using this fundamental data, maps showing the present state of land use were prepared based on the 1/10,000 scale topographical map of Kobe published in 1992 and that of Akashi published in 1993, respectively. Secondly, these fundamental data were input as vector data, using the GIS. Thirdly, the geographical co-ordinates were converted to the UTM (Universal Transverse Mercator) coordinate grid to prepare the coverage of land use. Fourthly, the statistics of the data covered in this coverage were prepared to analyze the current status of land use in each area.

The operating system of the computer used for this study was Solaris 2.4 of Sun Soft. The software ARC/INFO ver. 7.0.3 was used for the GIS, and Open Windows ver. 3.4 for statistical analysis.

2-2) Bird surveys and method of analysis

The route census method was used for bird surveys. This method is suitable for surveying the distribution of birds living in districts wherein is found a mosaic of varying land use.

In these surveys, records were taken on the species, the population number, and the location of the birds observed in an area extending approximately 25 meters on either side of the census routes chosen for this study.

A total of six surveys was conducted: twice a month, in the first and third weeks of each month in summer. The rural forest and farming areas were surveyed from June to August, 1995, and the farmland-dotted area on the edge of the city from June to August, 1997. The weather at the time of the surveys was clear or slightly cloudy. The survey hours were roughly four hours from dawn.

Using the data obtained from these surveys, the population number of birds observed was collected and added by species. Then, the diversity index for each area was calculated by month, using the Shannon-Weaver function.

Analysis Results and Discussion

1) Characteristics concerning the current status of land use in the three areas

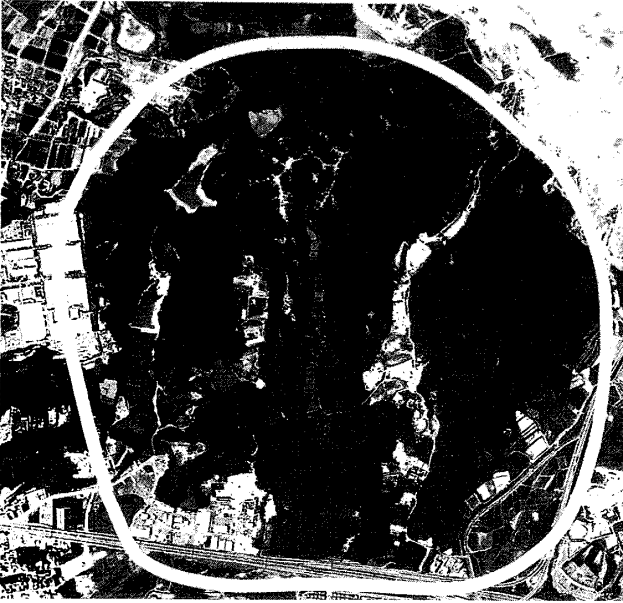
The rural forest area is 223.28 hectares of land, located in Midani, Tamatsu-cho, Nishi Ward, Kobe City, and also in Befu, Igawadani-cho. It mainly consists of second growth forests (Fig. 2).

54.0% of this area is occupied by forests of *Pinus densiflora* (Akamatsu) and *Quercus serrata* (Konara), which are typical secondary forest in Japan. Land not occupied by secondary forest is used in the following ratio: villages and built-up areas 16.0%, paddy field 11.9%, rivers and agricultural small reservoir 6.6%, which is a relatively high percentage for this category (Fig. 3).

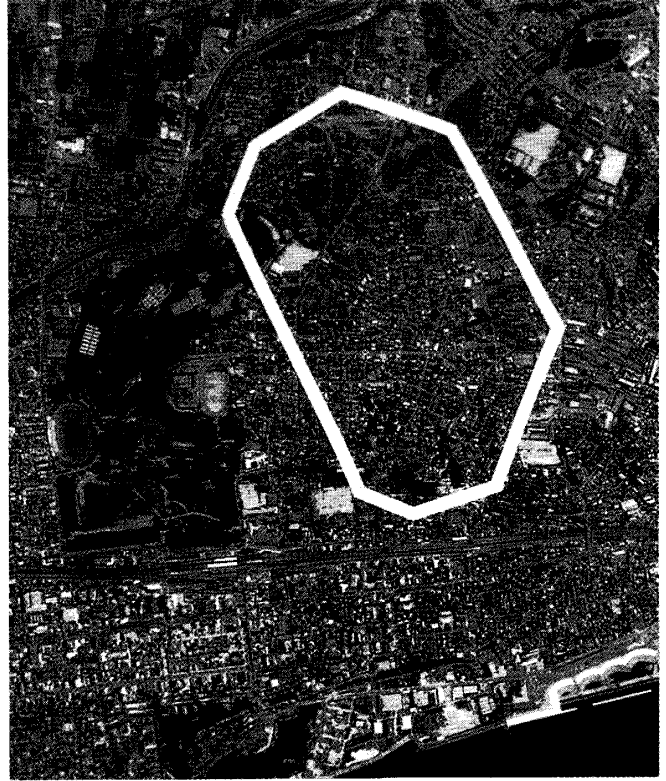
The farming area is a 354.95 hectares of valley, located in Zenkai and Kodera, Igawadani-cho, Nishi Ward, Kobe City, centered around I-kawa, a branch of Akashi-gawa, a class B river (Fig. 2).

This area displays a typical ratio of land use in farming communities located in the

Farming area
(Zenkai and Kodera, Igawadani-cho, Nishi Ward, Kobe City)



Urban area
(Taidera, Akashi City)



Rural forest area (Midani, Tamatsu-cho, Nishi Ward, Kobe City, and also Befu, Igawadani-cho)

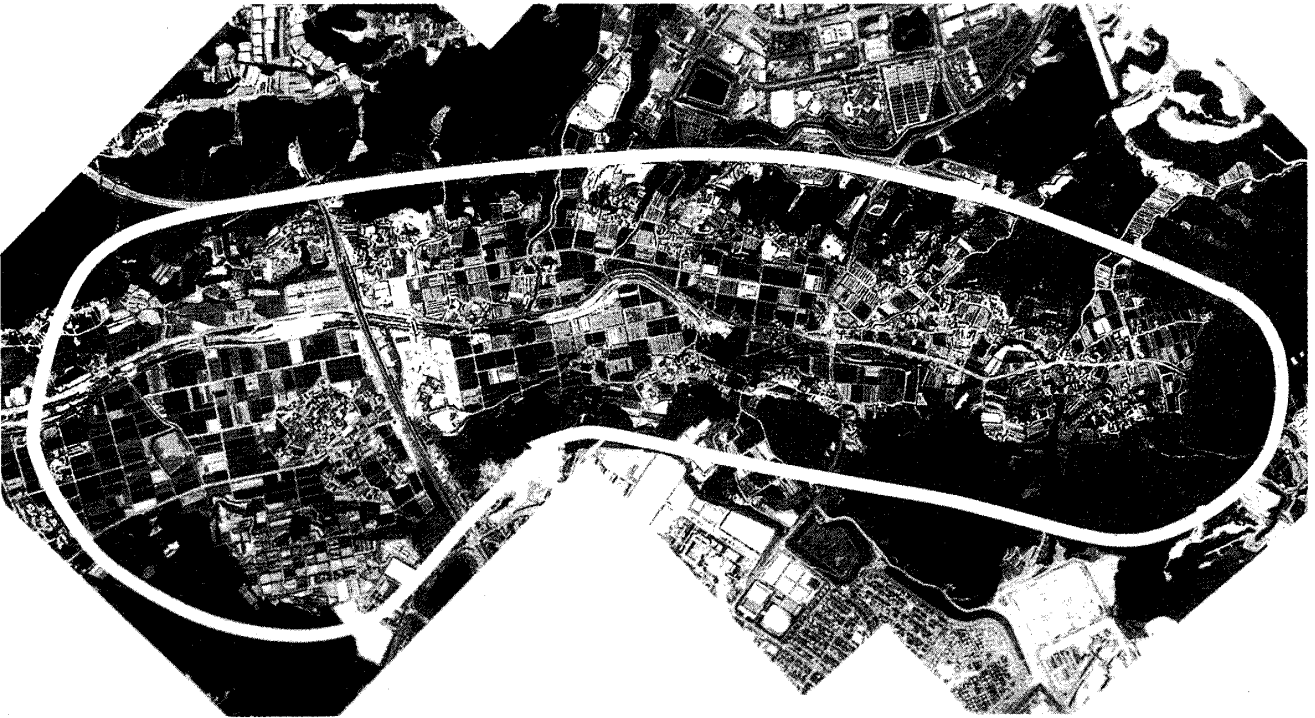


Fig. 2. Aerial photograph of the study area.

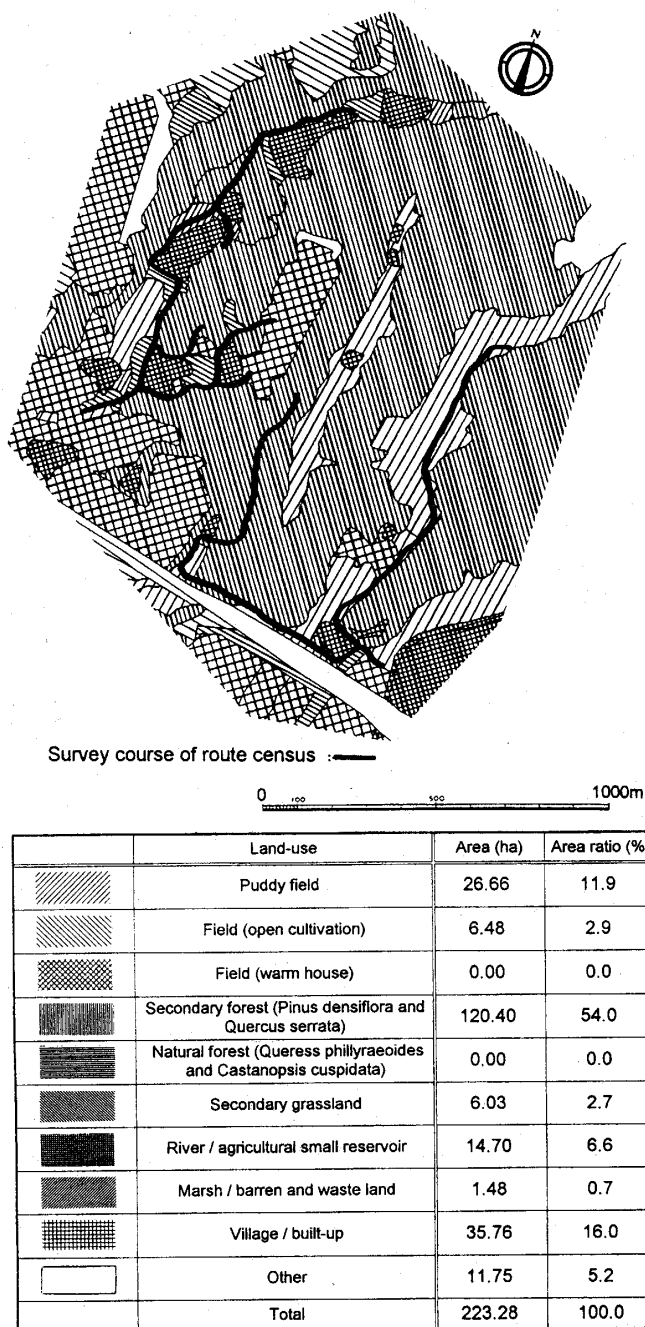


Fig. 3. Current status of land use and selection route census in rural forest area.

suburbs of big cities: paddy field 22.8%, villages and built-up areas 21.5%, and secondary forest 20.8%. In addition to these land uses, fields under open cultivation occupy 11.5%. This area shows the most variety of land use of the three areas selected for this study (Fig. 4).

The farmland-dotted, urban area is 89.74 hectares of land, centered around Taidera, Akashi City. This area is adjacent to Nishi Ward of Kobe City, and is characterized as a common residential area derived from a town originally built up around a castle (Fig. 2).

This area is highly developed, with residential areas occupying 79.1% of the entire area.

The farmlands have diminished to 5.7% of fields under open cultivation and 4.6% of paddy field (Fig. 5).

2) Current status of bird inhabitation

Table 1 shows the total population number of birds by species and the population number of birds observed per hectare, using the route census method.

The birds confirmed in this study were summarized as follows: 10 orders, 23 families and 35 species in the rural forest area; 9 orders, 20 families and 30 species in the farming area; and 4 orders, 10 families and 30 species, mostly birds found in cities, in the urban area.

To list the high-ranking species in terms of the population number of birds observed per hectare, city birds such as *Parus major* (Great tits : Shijukara), *Corvus corone* (Carrion crows : Hashibosogarasu), *Hypsipetes amaurotis* (Brown-eared bulbuls : Hiyodori), *Passer montanus* (Sparrows : Suzume) and *Hirun rustica* (Swallows : Tsubame) occupy high ranks in the rural forest area. The farming area shows a similar line of city birds as the rural forest area, except for the case of the *Parus major*.

From the results discussed above, it is assumed that both areas have been strongly affected

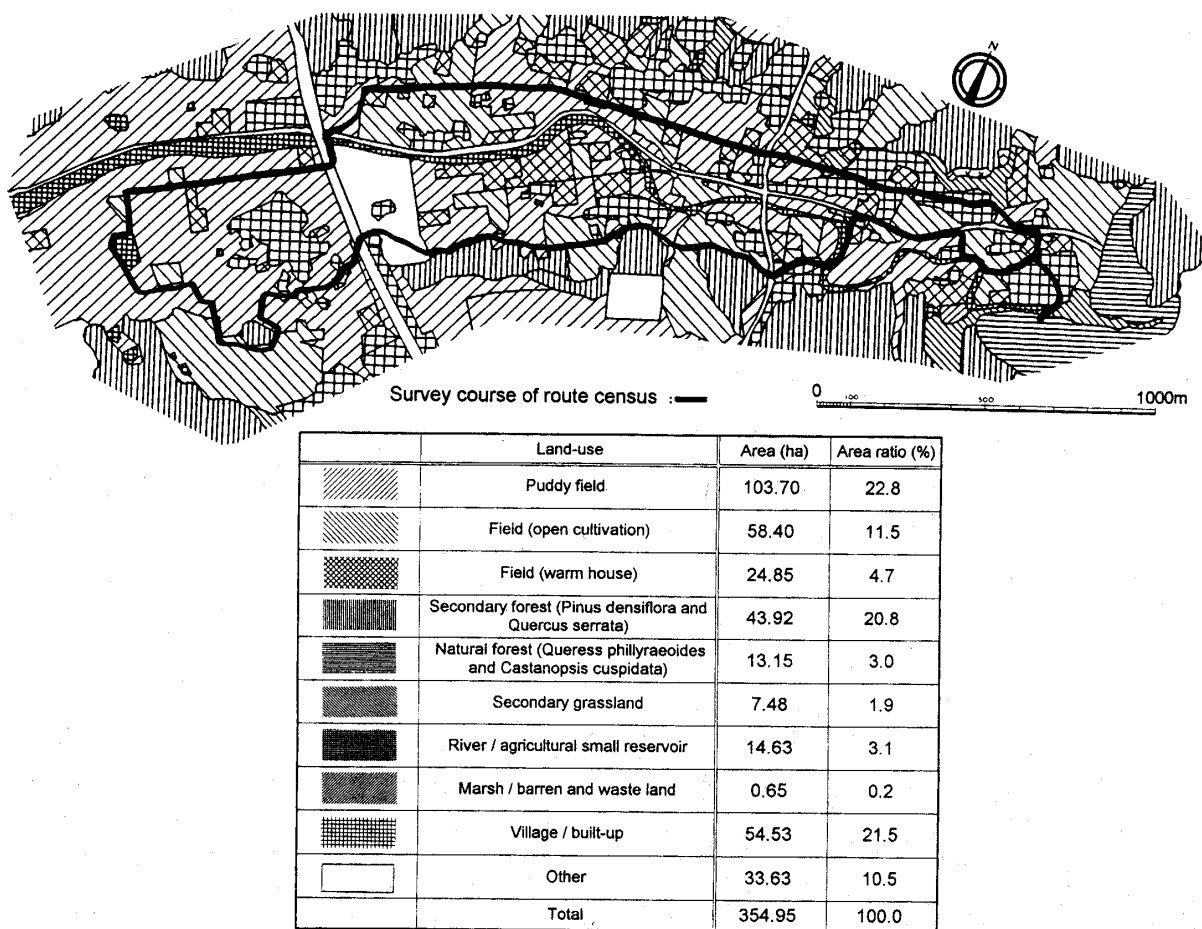
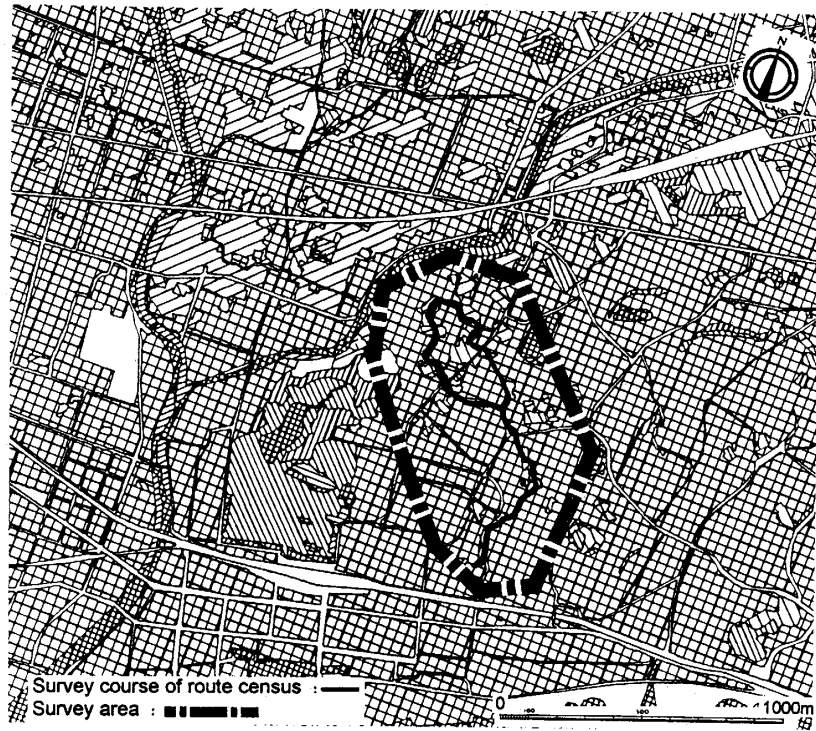


Fig. 4. Current status of land use and selection route census in farming area.













	Land-use	Area (ha)	Area ratio (%)
	Puddy field	4.15	4.6
	Field (open cultivation)	5.10	5.7
	Field (warm house)	1.85	2.1
	Secondary forest (<i>Pinus densiflora</i> and <i>Quercus serrata</i>)	0.68	0.8
	Natural forest (<i>Quercus phillyraeoides</i> and <i>Castanopsis cuspidata</i>)	0.00	0.0
	Secondary grassland	0.01	0.0
	River / agricultural small reservoir	2.25	2.5
	Marsh / barren and waste land	0.00	0.0
	Village / built-up	70.96	79.1
	Other	4.72	5.3
	Total	89.74	100.0

Fig. 5. Current status of land use and selection route census in urban area.

Table 1. List of avifauna

Study area	Rural forest area ('95)		Forming area ('95)		Urban area ('97)	
	Population number of bird	Population number of bird/ha	Population number of bird	Population number of bird/ha	Population number of bird	Population number of bird/ha
<i>Parus major</i>	46	1.35	12	0.29		
<i>Corvus corone</i>	43	1.26	22	0.53	9	0.68
<i>Hypsipetes amaurotis</i>	41	1.20	26	0.63	8	0.60
<i>Passer montanus</i>	36	1.05	51	1.24	26	1.96
<i>Hirun rustica</i>	30	0.88	28	0.68	22	1.66
<i>Corvus macrorhynchos</i>	26	0.76	16	0.39	28	2.11
<i>Passer varius</i>	22	0.64				
<i>Streptopelia orientalis</i>	20	0.59	12	0.29	8	0.60
<i>Cettia diphone</i>	11	0.32	2	0.05		
<i>Milvus migrans</i>	11	0.32	6	0.15	3	0.23
<i>Ardea cinerea</i>	10	0.29	2	0.05	3	0.23
<i>Phylloscopus borealis</i>	10	0.29	8	0.19		
<i>Alauda arvensis</i>	10	0.29	11	0.27	1	0.08
<i>Emberiza cioides</i>	8	0.23	4	0.10		
<i>Egretta garzetta</i>	8	0.23	8	0.19	3	0.23
<i>Anas poecilorhyncha</i>	8	0.23				
<i>Dendrocopos kizuki</i>	7	0.21	3	0.07		
<i>Phasianus colchicus</i>	7	0.21	6	0.15		
<i>Aegithalos caudatus</i>	7	0.21	7	0.17		
<i>Parus montanus</i>	6	0.18	4	0.10		
<i>Egretta alba</i>	5	0.15	2	0.05		
<i>Cuculus canorus</i>	5	0.15	0	0.00		
<i>Bambusicola thoracica</i>	4	0.12	6	0.15		
<i>Alcedo atthis</i>	3	0.09	1	0.02		
<i>Motacilla cinerea</i>	3	0.09	2	0.05		
<i>Nycticorax nycticorax</i>	3	0.09	1	0.02	1	0.08
<i>Motacilla grandis</i>	3	0.09	5	0.12	3	0.23
<i>Motacilla alba</i>	3	0.09	2	0.05	1	0.08
<i>Cuculus poliocephalus</i>	3	0.09	3	0.07		
<i>Microsarcops cineres</i>	3	0.09	7	0.17		
<i>Stumus cineraceus</i>	2	0.06			3	0.23
<i>Carduelis sinice</i>	2	0.06	2	0.05		
<i>Butastur indicus</i>	2	0.06				
<i>Butorides striatus</i>	1	0.03	3	0.07		
<i>Lanius cristatus</i>	1	0.03				
Total population number of bird	410	12.01	262	6.35	119	8.98
Total species number of bird	35	1.03	30	0.73	14	1.06
Route census area (ha)	34.13		41.25		13.25	
orders, families, species	10, 23, 35		9, 20, 30		4, 10, 14	

by urbanization, resulting in worsening environmental conditions through the spread of built-up areas.

However, in the rural forest area, we confirmed the existence of *Parus* family such as *Parus varius* (Varied tits : Yamagara) and *Parus montanus* (Willow tits : Kogara), which are birds which inhabit thickets in the warm climate. We also found *Phylloscopus borealis* (Arctic warblers : Mebosomushikui), *Emberiza cioides* (Siberian meadow buntings : Hoojiro), and *Butastur indicus* (Grey-faced buzzard-eagles : Sashiba). Also, in the farming area, water birds such as *Microsarcops cineres* (Grey-headed lapwings : Keri), *Motacilla* family (Wagtails : Sekirei) and *Alcedo atthis* (Kingfishers : Kawasemi) were seen. It suggests that both areas maintain, to some extent, the natural environment, although they have been influenced by urbanization. In the urban area, city birds as described above are mainly seen.

Especially, *Corvus macrorhynchos* (Jungle-crows : Hashibutogarasu) and *Passer montanus* were observed at a high ratio : 2.11 birds/ha and 1.96 birds/ha, respectively. It can be said that city birds, which are highly capable of adapting themselves to surroundings in a deteriorated environment, inhabit built-up areas.

Concerning the results in terms of birds species diversity in this study, Fig. 6 shows the diversity index in each survey area.

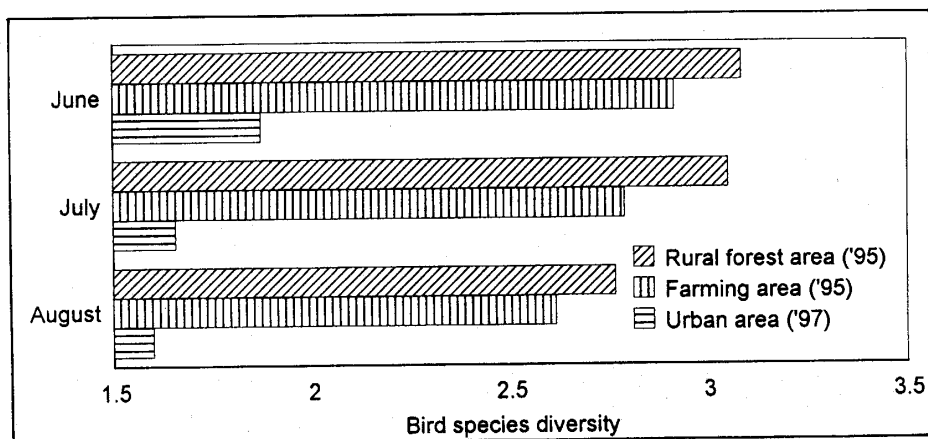


Fig. 6. Bird species diversity of the study area.

The indexes for the survey months of each area are 1.873 in June and 1.600 in August in the urban area; 3.087 in June and 2.767 in August in the rural forest area; and 2.916 in June and 2.617 in August in the farming area. The diversity index was low in the urban area, while it was high in the other two areas throughout the time of the surveys.

These results support the previous assumption that, in both the rural forest and farming areas, the natural environment needed for inhabitation of birds is conserved to some extent, although strongly affected by urbanization. That the urban area presents a non-favorable living environment for most birds is also supported by these study results.

Conclusion

The study results discussed above revealed that the rural forest and farming areas, located in the vicinity of urban areas, conserve a certain degree of natural environment required for inhabitation of birds, while experiencing strong effects of urbanization.

When comparing these two areas, the bird species observed in each area were different, but the diversity of the species and the population number of birds found showed similar values. Therefore, the comparison results suggest that, the farming area provides a favorable environment for bird inhabitation, which is equivalent to that of the rural forest area. This environmental preservation in the farming area may be ascribed to the fact that the area has a wide variety of land use such as villages with second growth forests and residential forests, rice paddy field and fields under open cultivation.

On the other hand, in the urban area, only city birds were observed, due to their high capacity of adaptation to the surrounding environment. This reveals that the environment in the urban area is not favorable for inhabitation by most birds.

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