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Characteristics of Breeding Bird Communities in Mt. Namsan, Seoul, Korea

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Abstract : This study was conducted to clarify the characteristics of breeding bird communities between deciduous and coniferous forests from April to June 2005 in Mt. Namsan, Seoul, Korea. Two 10ha areas were selected for territory mapping of breeding bird communities. Number of breeding bird species, pairs, density and bird species diversity index were higher in deciduous forest with increasing amount of foliage in the forest profile or as forest structures developed compared with coniferous forest. The number of species and pairs of bush/canopy nesting and foraging guilds were much greater in deciduous forest than in coniferous forest. The differences in habitat structure between both study areas are very likely to have influenced how breeding birds used the available habitat. Forest structure and its interactions with birds should be consideration in forest management for birds and their habitat.

Key words **:** *breeding bird community, coniferous forest, deciduous forest, Mt. Namsan, Seoul*

Introduction

There were many studies on habitat selection by breeding forest birds (MacArthur and MacArthur, 1961; Karr and Roth, 1971; Crawford *et al.*, 1981, Rhim and Lee, 2000). Also, tree species composition can affect avian community (Gabbe *et al.*, 2002; Park, 2005) and foraging behavior (Unno, 2002). But interaction among birds and habitat would be showed different patterns in urban forest areas.

By the human activities, ecosystem have been altered during the several past centuries (Noss and Cooperrider, 1994; Hur *et al.*, 2005). The urbanization would be most widespread forms of modification of the natural landscape. The habitat conditions of urban areas would be changed in many aspects. The bird community must be affected by habitat modifications (Lee and Rhim, 1998). There may be changed in species composition, habitat using pattern, distribution, etc.

The urbanization of the world that leaded overexploitation of forests and the transition to managed forests (Miller, 1988). To manage and protect of urban forest areas, it is important to understand the characteristics and relationships among components of the ecosystem.

Mt. Namsan is the most important and typical urban forest in Seoul metropolitan city. This study was conducted to clarify the relationship between breeding bird community and forest structure in Mt. Namsan for proper protection and management of avian community.

Methods

This study was conducted from April to July 2005 in Mt. Namsan (N 37° 32'~37° 33', E 126° 58'~127° 00'), Seoul, Korea. The study area was located in deciduous and coniferous forests around 200m above the sea level. The dominant species growing within the study area included *Quercus mongolica*, *Alnus hirsuta*, *Robinia pseudoacasia* and *Sorbus alnifolia* in deciduous forest, and *Pinus densiflora*, *Stephanandra incisa* and *Lespedeza bicolor* in coniferous forest (Lee *et al.*, 1998).

Territory mapping of breeding bird communities was conducted in two different areas, each with an area of 10ha (250 × 400m), selected as deciduous and coniferous forests. Each study area was divided into grids consisting of a 25 × 25m array marked with flags, facilitating accurate territory mapping (Rhim and Lee, 2000).

In order to describe quantitatively the habitat, variables of the forest structure, such as foliage height profile and DBH (diameter at breast height) of trees, were recorded in areas of woodland five meters in diameter in each 25 × 25m square.

Foliage height was classified into five vertical layers.

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Table 1. Category of nesting and foraging guilds.

Guild	Nesting or foraging site	Abbreviation
Nesting guild		
Bush	bush, ground	B
Canopy	canopy	C
Hole	tree hole	H
Foraging guild		
bush	vine, litter, bush, fallen log, ground	b
canopy	leaf, twig, branch, trunk, bud	c

The high canopy was 12~16m above the ground. the mid-canopy layer at 6~12m, the low canopy layer at 2~6m, the understory layer at 1~2m, and the ground-bush layer was less than 1m high. Numeric values were assigned to percentages of foliage cover, e. g. foliage cover of 0% was 0, 1~33% was 1, 34~66% was 2, and 67~100% was 3 (Lee, 1996; Rhim and Lee, 2000).

Breeding bird communities were surveyed between April 17 and June 28, 2005. In each study area, 10 censuses were conducted by mapping out each species' territory (Kendeigh, 1944; Bibby *et al.*, 1997; Lee *et al.*, 1999). Bird species diversity (Shannon and Weaver, 1949) and guild structure (Root, 1967) were used in the analysis of breeding bird communities. According to the nesting and foraging site of breeding bird species, the breeding bird community was classified in the nesting and foraging guild (Simberloff and Dayan, 1991). The nesting guild was divided into canopy, hole, and bush, and the forging guild was into canopy and bush (Table 1).

Bird species diversity values were calculated by the following equation (Shannon and Weaver, 1949).

$$H' = \sum_{i=1}^{s} (Pi) \times \ln(Pi)$$

where s is the number of categories and P*i* is the proportion of individuals in the *i* th category.

Results and Discussion

The average foliage profiles were different in both study areas (Figure 1). All vertical foliage layers were more higher coverage in deciduous forest than in coniferous forest. Especially, understory and canopy coverage were more higher than the other layers in deciduous forest.

The DBH distribution of trees were similar in deciduous and coniferous forests. The DBH distributions were simple. Most of the trees were belong to 10~19cm class of DBH in both study areas. There was no large tree, which is over 50 cm of DBH (Figure 2).

Breeding bird community was somewhat poor in Mt. Namsan area, especially bird species richness and

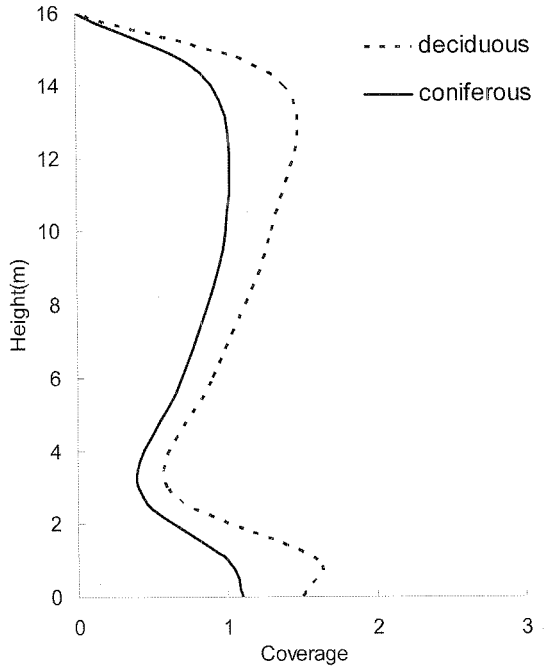

Figure 1. Vertical foliage structure in deciduous and coniferous forests at Mt. Namsan, Seoul, Korea.

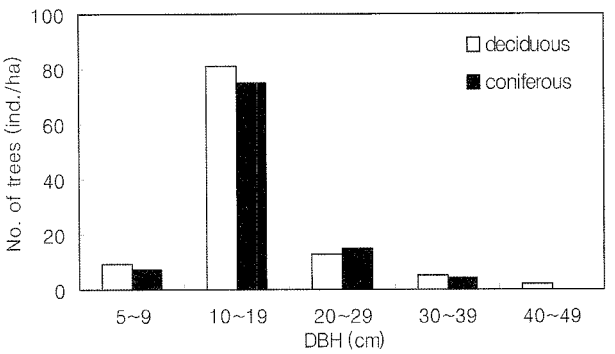

Figure 2. DBH distribution of trees (>5 cm of DBH) in deciduous and coniferous forests at Mt. Namsan, Seoul, Korea.

diversity, and breeding density. Number of breeding bird species, pairs, density and bird species diversity index were higher in deciduous forest with increasing amount of foliage in the forest profile or as forest structures developed compared with coniferous forest (Table 2).

In this study, *Streptopelia orientalis*, *Paradoxornis webbianus*, *Parus major* and *Emberiza elegans* were commonly bred in both study areas. *Parus major* and *Paradoxornis webbianus* were most dominant breeding bird species. At deciduous forest, there were 17 breeding pairs of 9 species. *Parus major* and *Paradoxornis webbianus* comprised 47% of the breeding bird pairs. Only single pairs of *Streptopelia orientalis*, *Phylloscopus coronatus*, *Aegithalos caudatus*, *Emberiza elegans* and *Oriolus chinensis* bred at deciduous forest.

Table 2. Breeding bird communities in deciduous and coniferous forests at Mt. Namsan, Seoul, Korea.

Species	Guild		Deciduous forest	Coniferous forest	Mig.[3]
	N[1]	F[2]			
Accipiter soloensis			+		S.V.
Phasianus colchicus	B	b	2*	+	Res.
Streptopelia orientalis	C	b	1	1	Res.
Cuculus canorus			+		S.V.
Otus scops			+		S.V.
Dendrocopos kizuki			+	+	Res.
Dendrocopos major			+		Res.
Hirundo rustica			+		S.V.
Hypsipetes amaurotis				+	Res.
Luscinia sibilans			+	+	P.M.
Luscinia cyane			+		S.V.
Tarsiger cyanurus			+		P.M.
Zoothera dauma			+		S.V.
Turdus pallidus			+		S.V.
Phylloscopus coronatus	B	c	1	+	S.V.
Ficedula zanthopygia			+		S.V.
Ficedula mugimaki			+		P.M.
Paradoxornis webbianus	B	b	3	1	Res.
Aegithalos caudatus	C	c	1		Res.
Parus varius			+		Res.
Parus palustris			+	+	Res.
Parus ater	H	c	+	4	Res.
Parus major	H	c	5	2	Res.
Emberiza elegans	B	b	1	1	Res.
Passer montanus			+		Res.
Oriolus chinensis	C	c	1		S.V.
Garrulus glandarius			+		Res.
Pica pica	C	b	2	+	Res.
No. of breeding species			9	5	
No. of breeding pairs			17	9	
Breeding density (ind./ha)			3.4	1.8	
Bird species diversity (H')			2.00	1.43	

1. N: nesting guild - B: bush, C: canopy, H: hole
2. F: foraging guild - b: bush, c: canopy
3. Mig.: migration type - Res.: resident, S.V.: summer visitor, W.V.: winter visitor, P.M.: passage migrant
*No. of breeding pairs
† : The species were present in the study site but had no territories.

At coniferous forest, 9 pairs of 5 species bred. *Parus ater* and *P. major* were the dominant breeding species and comprised 67% of the breeding bird pairs. Only single pairs of *Streptopelia orientalis*, *Paradoxornis webbianus* and *Emberiza elegans* bred at coniferous forest.

Phasianus colchicus and *Pica pica* were understory foragers, and *Aegithalos caudatus* and *Oriolus chinensis* were canopy nest builder (see Table 2). Those species were only found in deciduous forest. Because there was the combination of dense understory vegetation and higher coverage in canopy layer (see Figure 1).

Five pairs of 1 species and 6 pairs of 2 species belonging to hole nesting guild in deciduous and coniferous forests, respectively. The number of species and pairs of bush/canopy nesting and foraging guilds were much greater in deciduous forest than in coniferous forest (Table 3). Bush/canopy nesting and foraging guilds predominated in deciduous forest. As the coverage of bush and canopy layers were increased, structure of the habitat available for bush/canopy nesting and foraging guilds changed.

Table 3. Differences in guild structure of breeding bird communities between deciduous and coniferous forests at Mt. Namsan, Seoul, Korea.

Guild	Deciduous forest		Coniferous forest	
	No. of species (dominance, %)	No. of individuals (dominance, %)	No. of species (dominance, %)	No. of individuals (dominance, %)
Nesting guild				
Bush	4 (44.4)	7 (41.2)	2 (40.0)	2 (22.2)
Canopy	4 (44.4)	5 (29.4)	1 (20.0)	1 (11.1)
Hole	1 (11.1)	5 (29.4)	2 (40.0)	6 (66.7)
Foraging guild				
bush	5 (55.6)	9 (52.9)	3 (60.0)	3 (33.3)
canopy	4 (44.4)	8 (47.1)	2 (40.0)	6 (66.7)

The number of breeding species and pairs differed between both study areas. The vertical forest structure also differed between two study areas. The differences in habitat structure between both study areas are very likely to have influenced how breeding birds used the available hatitat (Lee, 1996; Rhim and Lee, 2000; Rhim and Lee, 2001).

In urban forest such as Mt. Namsan, there were a lot of disturbance factor for forest ecosystem by human activities. Also, forest structure could be changed by human usage. Forest structure is clearly very important for forest breeding birds and it appears to be an important factor in determining whether certain species are either present or absent (Lee *et al.*, 2000; Rhim and Lee, 2005).

The higher taxonomic and structural diversity of a mixed-age and mixed-species forest ecosystem provides an opportunity for maximum bird species diversity (Lee, 1996). Forest with greater structural complexity offer a greater variety of resources for birds. Forest structure and its interactions with birds should be consideration in urban forest management for birds and their habitat.

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