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# Differences in Breeding Bird Communities Between Deciduous Forests of Gwangneung and Mt. Namsan Areas

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**Abstract :** This study was conducted to clarify the differences in breeding bird communities between deciduous forests of Gwangneung and Mt. Namsan areas from April to August 2006. Two 10ha area were selected for territory mapping of breeding bird community in both study area. The DBH distribution of trees and average foliage profiles were significantly different between study areas. Also, breeding bird communities were different. Number of breeding species and pairs, breeding density, and bird species diversity were higher in Gwangneung area than in Mt. Namsan area. When examining relationship between forest habitat structure and bird community, Number of bird species and breeding pairs belonged to hole and canopy guild were increase as the increase of coverstory coverage and number of large trees. Therefore, it is necessary to make vertical structure more various to plant bushes, and to make DBH distribution more diverse for enhancing bird species diversity in the degraded ecosystem.

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

## Introduction

Ecosystem have been disturbed during the several past centuries by the human activities (Noss and Cooperrider, 1994). Especially, urbanization would be most widespread forms of modification of the natural habitat of wildlife (Forman *et al.*, 2003). The habitat conditions would be changed in functional and structural aspects of ecosystem by urbanization. Degraded forests would be dramatically increased in the world (Rhim, 2006). Degraded forest lands are necessary to improve biological and habitat diversity at the landscape level, increase commercial value for timber and pulp production, increase kinds and amount of non-timber products, increasing forest function such as water balance, fixation of carbon dioxide, climate mitigation, amnesty etc. (Kobayashi, 2001).

Forest and wildlife management could be carried on in many areas indefinitely without ecosystem degradation or other severe consequences, but ecosystem management demands more than sustainable yields of natural resources (Boyce and Haney, 1997). Forest ecosystem management does not focus primary on the deliverables but rather on sustainablility of ecosystem structures and processes necessary to delivery goods and services (Christensen *et al.*, 1996).

It is necessary the integrated study on structure and function of forest ecosystem including biological characteristics of wildlife and interactions between their habitat (Small and Hunter, 1988). The bird community must be affected by habitat disturbances. There may be changed in species composition, habitat using pattern, distribution, etc. (Lee and Rhim, 1998). Therefore, characteristics of bird communities would be indicator of status of forest ecosystem, especially in degraded forest.

Mt. Namsan area supposed to be a disturbed ecosystem and Gwangneung area considered to be a natural ecosystem (Ministry of Environment, 1996) were selected for this study. This study was conducted to collect basic data for restoration of bird species diversity in degraded forest ecosystem.

## Methods

This study was conducted in deciduous forests of Gwangneung (N 37° 42' ~ 37° 47', E 126° 58' ~ 127° 00') and Mt. Namsan areas (N 37° 32' ~ 37° 33', E 126° 58' ~ 127° 00') from April to August 2006. Gwangneung area was located northen part of Seoul Metropolitan. The study area was 220m above the sea level. *Carpinus laxiflora, Quercus mongolica,* and *C. cordata* were domi-

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nant tree species in deciduous forest of Gwangneung area (Rhim *et al.*, 2007). Mt. Namsan area was located in middle part of Seoul Metropolitan. The study area was 200 m above the sea level. The dominant species were *Quercus mongolica, Alnus hirsuta, Robinia pseudoacasia,* and *Sorbus alnifolia* (Lee *et al.*, 1998). Study sites were selected with 10ha (250 × 400 m) in both areas. Each study area was divided into grids consisting of a 25 × 25 m 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 × 25 m square. Foliage height was classified into six vertical layers, such as >16 m, 12~16 m, 6~12 m, 2~6 m, 1~2 m, and less 1 m from the ground. 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 *et al.*, 2007).

Breeding bird communities were surveyed by territory mapping method from April 10 to June 30, 2006. In each study area, 9 censuses were conducted by mapping out each species' territory (Bibby *et al.*, 1997; Lee *et al.*, 1999; Rhim *at al.*, 2006). 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 bush, canopy, and hole, and the forging guild was into air, bush, and canopy (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.

**Table 1. Category of nesting and foraging guilds in this study.**

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

## Results and Discussion

The DBH distribution of trees were significantly different between deciduous forests in Gwangneung and Mt. Namsan areas. Tree densities were significantly higher (t-test, 5~9 cm, t=1.28, p=0.05; 20~29 cm, t= -2.39, p=0.01; 30~39 cm, t= -3.41, p=0.01; 40~49 cm, t= -2.67, p=0.05) in Gwangneung area except the 10~19 cm class (t=4.69, p=0.03). Most of the trees belonged to 10~19 cm class of DBH in Mt. Namsan area. But there were large trees (> 40 cm of DBH) in Gwangneung area (Figure 1).

The average foliage profiles were different between study areas. the coverages were similar in understory (<2 m from ground) vegetation. But coverages of the other foliage layers were higher (2~6 m, t= -3.15, p=0.01; 6~12

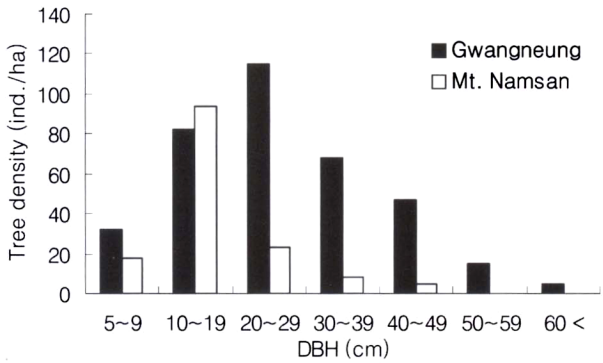


**Figure 1. Differences in DBH distribution of trees (>5 cm of DBH) between deciduous forests of Gwangneung and Mt. Namsan areas.**

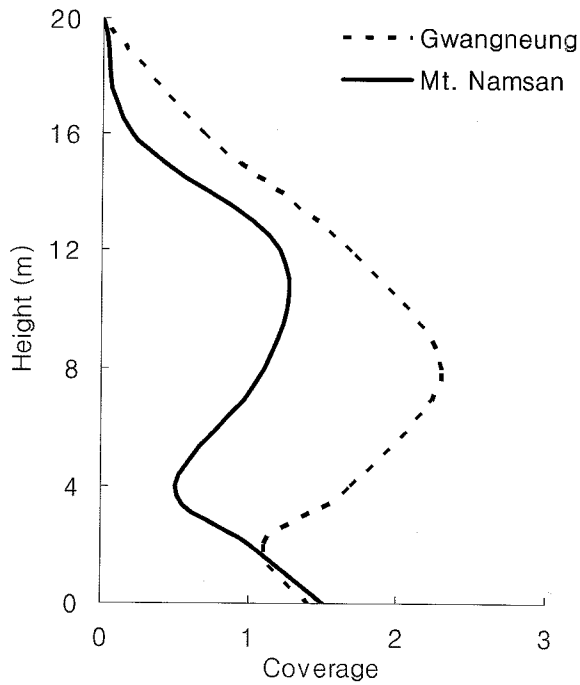


**Figure 2. Differences in vertical foliage structure between deciduous forests of Gwangneung and Mt. Namsan areas.**

**Table 2. Differences in breeding bird communities between deciduous forests of Gwangneung and Mt. Namsan areas.**

| Korean name | Scientific name | Guild | | Gwangneung | Mt. Namsan | Mig.[3] |
|---|---|---|---|---|---|---|
| | | N[1] | F[2] | | | |
| 들꿩 | *Bonasa bonasia* | B | b | 1* | | Res. |
| 꿩 | *Phasianus colchicus* | B | b | | 1 | Res. |
| 멧비둘기 | *Streptopelia orientalis* | C | b | 1 | 1.5 | Res. |
| 매사촌 | *Cuculus fugax* | - | - | 0.5 | | S.V. |
| 검은등뻐꾸기 | *Cuculus micropterus* | - | - | 1 | | S.V. |
| 뻐꾸기 | *Cuculus canorus* | - | - | + | + | S.V. |
| 벙어리뻐꾸기 | *Cuculus saturatus* | - | - | + | | S.V. |
| 쇠딱다구리 | *Dendrocopus kizuki* | H | c | 2.5 | + | Res. |
| 오색딱다구리 | *Dendrocopus major* | H | c | 0.5 | + | Res. |
| 큰오색딱다구리 | *Dendrocopus leucotos* | H | c | 1 | | Res. |
| 청딱다구리 | *Picus canus* | H | c | 1.5 | | Res. |
| 까막딱다구리 | *Dryocopus martius* | H | c | + | | Res. |
| 직박구리 | *Hypsipetes amaurotis* | C | c | + | + | Res. |
| 울새 | *Luscinia sibilans* | B | b | | + | Res. |
| 쇠유리새 | *Luscinia cyane* | B | b | 3.5 | + | S.V. |
| 유리딱새 | *Tarsiger cyanurus* | - | - | + | + | P.M. |
| 호랑지빠귀 | *Zoothera dauma* | C | b | 1 | + | S.V. |
| 흰배지빠귀 | *Turdus pallidus* | C | b | 2 | + | S.V. |
| 되지빠귀 | *Turdus hortulorum* | C | b | + | | S.V. |
| 숲새 | *Urosphena squameiceps* | B | b | 2 | | S.V. |
| 산솔새 | *Phylloscopus coronatus* | B | c | 1 | 1 | S.V. |
| 흰눈썹황금새 | *Ficedula zanthopygia* | H | a | 1 | | S.V. |
| 큰유리새 | *Cyanoptila cyanomelana* | B | a | 1 | | S.V. |
| 붉은머리오목눈이 | *Paradoxornis webbianus* | B | b | | 3.5 | Res. |
| 오목눈이 | *Aegithalos caudatus* | C | c | 1.5 | 1.5 | Res. |
| 곤줄박이 | *Parus varius* | H | c | 8 | + | Res. |
| 쇠박새 | *Parus palustris* | H | c | 4 | + | Res. |
| 진박새 | *Parus ater* | H | c | 3 | + | Res. |
| 박새 | *Parus major* | H | c | 3.5 | 4 | Res. |
| 동고비 | *Sitta europaea* | H | c | 2.5 | | Res. |
| 노랑턱멧새 | *Emberiza elegans* | B | b | 3 | 1 | Res. |
| 참새 | *Passer montanus* | B | b | | 1 | Res. |
| 꾀꼬리 | *Oriolus chinensis* | C | c | + | 0.5 | S.V. |
| 어치 | *Garrulus glandarius* | C | c | 1.5 | + | Res. |
| 까치 | *Pica pica* | C | b | | 1.5 | Res. |
| 까마귀 | *Corvus corone* | C | b | + | | Res. |
| No. of breeding species | | | | 23 | 10 | |
| No. of breeding pairs | | | | 47.5 | 16.5 | |
| Breeding density (pairs/ha) | | | | 4.75 | 1.65 | |
| Bird species diversity (H') | | | | 2.89 | 2.11 | |

1. Nesting guild - B: bush, C: canopy, H: hole
2. Foraging guild - a: air, b: bush, c: canopy
3. Migration - Res.: resident, S.V.: summer visitor, W.V.: winter visitor, P.M.: passage migrant
* : No. of breeding pairs
\+ : The species which were present in the study areas but had no territories

m, t= -3.78, p=0.005; 12~16 m, t= -1.39, p=0.01; >16 m, t=1.32, p=0.05) in deciduous forest of Gwangneung than of Mt. Namsan area (Figure 2).

Breeding bird communities were different between study areas. Number of breeding species and pairs, breeding density, and bird species diversity were higher

**Table 3. Differences in guild structure of breeding bird communities between deciduous forests of Gwangneung and Mt. Namsan areas.**

| Guild | Gwangneung | | Mt. Namsan | |
|---|---|---|---|---|
| | No. of species (dominance, %) | No. of pairs (dominance, %) | No. of species (dominance, %) | No. of pairs (dominance, %) |
| Nesting guild | | | | |
| Bush | 6 (28.6) | 11.5 (25.0) | 5 (50.0) | 7.5 (45.5) |
| Canopy | 5 (23.8) | 7.0 (15.2) | 4 (40.0) | 5.0 (30.3) |
| Hole | 10 (47.6) | 27.5 (59.8) | 1 (10.0) | 4.0 (24.2) |
| Foraging guild | | | | |
| air | 2 ( 9.5) | 2.0 ( 4.4) | - | - |
| bush | 7 (33.3) | 13.5 (29.3) | 6 (60.0) | 9.5 (57.6) |
| canopy | 12 (57.2) | 30.5 (66.3) | 4 (40.0) | 7.0 (42.4) |

in deciduous forest of Gwangneung area than of Mt. Namsan area (Table 2).

In this study, *Streptopelia orientalis, Phylloscopus coronatus, Aegithalos caudatus, Parus major,* and *Emberiza elegans* were commonly bred in both study areas. Forty seven and half pairs of twenty three species were bred in deciduous forest of Gwangneung area. Also, *P. varius, P. palustris, Luscinia cyane,* and *P. major* were dominant breeding bird species. only half pair of *Cuculus fugax* and *Dendrocopus major,* and one pair of *Bonasa bonasia, Streptopelia orientalis, C. micropterus, D. leucotos, Zoothera dauma, Phylloscopus coronatus, Ficedula zanthopygia,* and *Cyanoptila cyanomelana* bred at deciduous forest of Gwangneung area.

In deciduous forest of Mt. Namsan area, 16.5 pairs of 10 species bred. *Paradoxornis webbianus* was the dominant breeding bird species. Only half pair of *Oriolus chinensis,* and one pair of *Phasianus colchicus, Phylloscopus coronatus, Emberiza elegans,* and *Passer montanus* were bred.

In deciudous forest of Gwangneung area, most of the breeding bird species belonged to hole/canopy nesting and foraging guilds. Also, there were did bush nesting and foraging guilds in Mt. Namsan area (Table 3). When examining relationship between forest habitat structure and bird community, Number of bird species and breeding pairs belonged to hole and canopy guild were increase as the increase of coverstory coverage and number of large trees (See Figure 1 and 2, and Table 3).

The number of breeding species and pairs differed between both study areas. The vertical forest structure also differed between 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). Also, Number of species and breeding pairs of hole nesting guild were higher in deciduous forest of Gwangneung area because of various DBH distributional pattern, and BSD (bird species diversity) were correlated with FHD (foliage height diversity). Therefore, it is necessary to make vertical structure more various to plant bushes, and to make DBH distribution more diverse for enhancing bird species diversity in the degraded ecosystem (Ministry of Environment, 1996; Adams *et al.*, 2006).

In forest bird communities, more heterogenious habitat provide more various environment for inhabiting birds and eventually support high bird species diversity (Boyce and Haney, 1997; Johnson and O'Neil, 2001). In order to understand and restore bird species diversity in certain habitat, it is necessary to study forest environment, inhabiting bird community, and relationship among birds (Dickson *et al.*, 1979; Conover, 2002; Rhim, 2006). We concluded that Mt. Namsan area would be needed to make habitat more diverse and to enhance the structural and functional aspect of degraded forest.

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