Habitat feature analysis in urban biotope for bird diversity promotion in Seoul urban area

서울시의 조류다양성 증진을 위한 도시비오톱 특성 분석

채진확, 구태회

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Keywords : bird diversity, high-disturbed biotope, habitat size, low-disturbed biotope, occurrence rate

목차

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Ⅰ. Introduction

Urbanization is likely to top agriculture as the dominant agent of fragmentation at the global scale (Marzluff and Ewing, 2001). Currently only about 3% of the earth's surface is covered with buildings and other urban structures (Meyer and Turner, 1992). More importantly, the sprawl associated with many urban centers and the current tendency in developed countries to subdivide and settle formerly extensive ranches and wildlands (Berry, 1990; Knight et al., 1995; Buechner and Sauvajot, 1996) means that increasingly large portions of the earth are fragmented by some form of human settlement (Marzluff and Ewing, 2001). For example, Economic development policy and the urbanization of Seoul in Korea have caused the destruction of forests and damage to wetlands. This, various species of native plants and animals have become vulnerable to extinction.

Most of the earlier researches directed towards determining the habitat needs of various birds has focused on 'natural' communities, while urban ecosystems were largely ignored. However, with the rapid expansion of urban development, the importance of understanding the relationship between wildlife and urban habitats is evident (Jokimäki and Suhonen, 1998). Studies surveying multiple sites within urban areas (e.g. Mills et al., 1989; Jokimäki and Suhonen, 1998) demonstrate variation in the capacity of different developed sites to support bird populations. This suggests that we have a opportunity to design better urban landscapes in order to sustain birds than those we live in now. On the other hand, planning and making design decisions make an great impact on the urban landscape, which in turn affects animal diversity. Traditionally ecologists used to choose to measure some natural features in a landscape (e.g., tree patches) and ask how the distribution of these features affect the distribution of animals (Hostetler, 1999). Then, a long-term goal of urban ecologist should be able to uncover the factors regulating the success or failure of species in inhabited areas and use these factors to develop principles for the design of urban landscapes compatible with nature (Turner, 2003).

This study is to survey bird diversity with habitat feature for urban biotope in Seoul, Korea and to study the relationship between bird diversity.

The goal of this study is to survey 1) the relationship between diversity and characteristic of habitat. 2) the relationship between area and bird species in habitat 3) the realistic and effective restoration method of existing habitats and establishment of new habitats.

Ⅱ. Methods

2.1. Study site

The study area, Seoul in Korea, has been heavily affected by urbanization. The nation's densely populated capital; 10.2 million people residing the area of within roughly 605km^2. There are a total of 1,405 parks with total land area of 154.06km^2 in Seoul, taking up about 25% of the City of Seoul. The ratio of park area per person is 14.83m^2, comparable with that of other major cities in the world. More than 80% of the parks are, however, located in the outer sites of the City. As a result, there is a lack of nearby green areas and parks for the citizens to frequent easily in daily life.

In particular, most metropolitan areas have land use maps. In case of Seoul, it has present biotope map (Fig. 2-1). Biotope materialization is made by land use, impermeable pavement ratio and present vegetation data attained through field survey. Because of feature of urban space, the present land use with human activity is the principle axis of biotope materiality division. the data were derived from the report by Seoul city (For more detail, See Report of Plan study ecosystem restoration and biodiversity promotion with biotope type in Seoul Ⅰ,Ⅱ : 2002, 2003).

In detail, it is divided into Residential Area Biotope, Commercial or Business Area Biotope, Industrial or Urban Infrastructure Facilities Area Biotope, Transportation Facilities Biotope, Landscape or Green Area Biotope, Farmland Biotope, Forest biotope. In this map the word "biotope" is synonymous with the word "habitat", and is defined as any demarcated area in which animals and plants can live, and thus primarily represents different land-use classes.

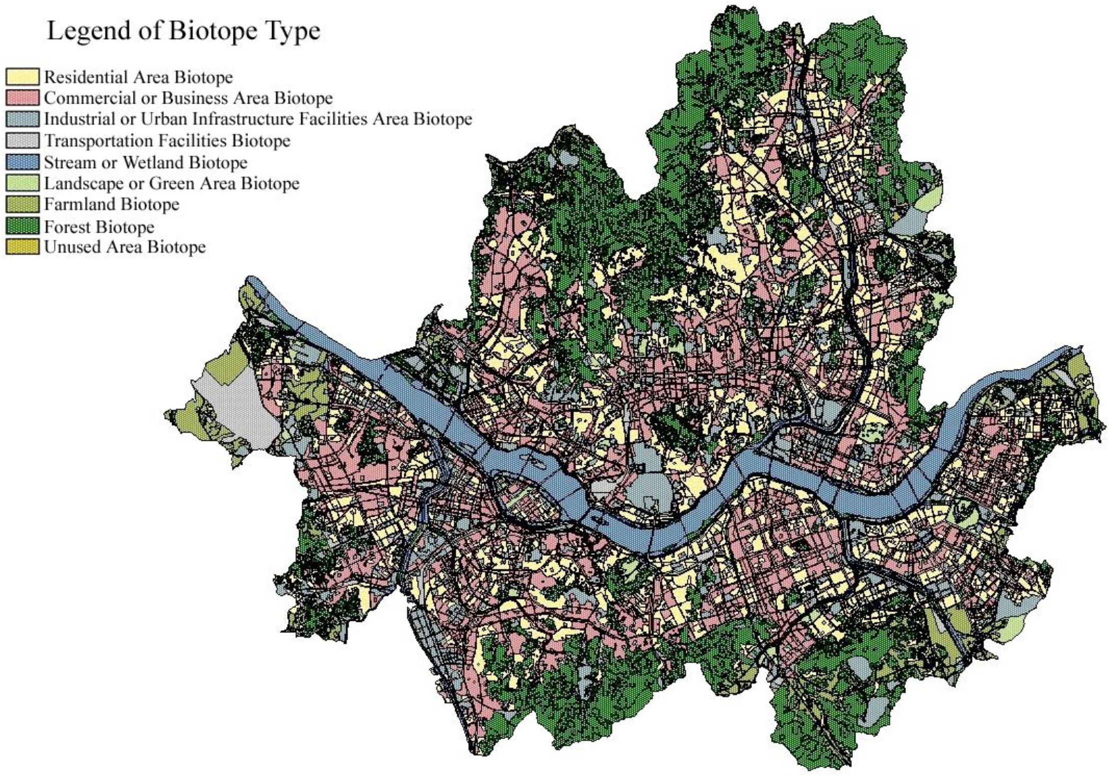
For this study, we classified entire biotope of Seoul City as high-disturbed biotope and low-disturbed biotope. Research area has been randomly selected to contain all biotope type(n=74). The main factors taken into account for classification of high-disturbed biotope and low-disturbed biotope are land utilization intensity by human and impermeable pavement area. In other words, Residential Area Biotope, Commercial or Business Area Biotope, Industrial or Urban Infrastructure Facilities Area Biotope, Transportation Facilities Biotope have been considered as high-disturbed biotope. Landscape or Green Area Biotope, Farmland Biotope, Forest biotope were classified as low-disturbed biotope.

2.2. Data analysis

Based on the research site's characteristic, transect count and point census method was used abreast. we used a single-visit study plot method specifically for high-disturbed biotope. A survey plot was not consisted of a single route in a plot, but rather a zigzag walk through the plot. Thus we also inspected the backyards of the houses and buildings. This kind of transect count reduces many problems associated with counting birds in urban areas, such as varying noise and visibility (DeGraaf et al., 1991). Different census speed was applied with different spatial scales. In average, the census speed was quite high (2ha/10min) to avoid double counts of individuals. Surveys were not conducted during rainy or extremely windy conditions (greater than 20 mph). To include the fall and spring migration seasons, all surveys were completed in each site from October to November in 2001, 2002and from May to June in 2002. All surveys were conducted within 4hours after sunrise by the two same investigators.

Two areas with completely different characteristic were selected and bird diversity was compared by analyzing the occurrence rates of each species. In order to analyze the change of occurrence rates, the areas were divided into three subareas (<1, 1-10, >10 ha). The occurrence rate of each species was obtained by dividing the number of sites present by the total number of sites in each subarea.

To observe variation of bird diversity in relation with cumulative area, we made cumulative species-area curves. Also, this cumulative species-area curves were used to assess the contribution that small patches made to species richness and compare Low-disturbed biotope with High-disturbed biotope about bird diversity. Patch areas placed in order from small to large, and values for cumulative area as well as cumulative number of species were calculated (Quinn and Harrison, 1988).



<Figure 2-1> Present biotope map of Seoul.

Ⅲ. Results

The dimension of high-disturbed biotope and low-disturbed biotope observed was almost equal(Table 3-1). 18 species of birds were observed at high-disturbed biotope(n=35), 157.01ha. And 23 species of birds were observed at low-disturbed biotope(n=39), 135.96ha.

According to the census, the diversity of low-disturbed biotope was richer than high-disturbed biotope(Table 3-2). This could mean that low-disturbed biotope's environment is more appropriate for birds' habitation than high-disturbed biotope. In other hands, occurrence and intervention of human could negatively affect habitation of birds at high-disturbed biotope.

Occurrence of *Passer montanus* and *Pica pica* which can easily be found in urban areas was similar in entire areas (Table 3-3).

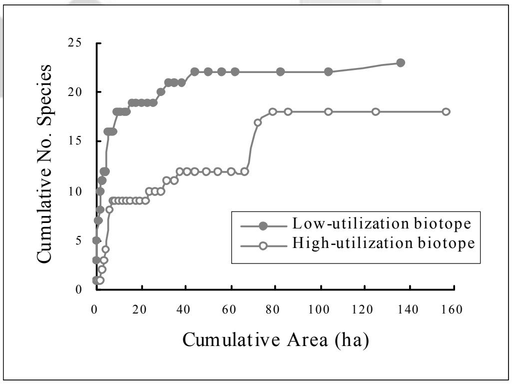
Studying the increase of bird diversity variation with respect to habitat size, most of species appeared in size (1-10ha), rather than in size (<1ha, >10ha). At the high-disturbed biotope, two species of birds were found in biotopes up to 1ha (n=5), 18 species were found in biotopes of 1-10ha (n=27) and 6 species were found in biotopes larger than 10ha (n=3). Also, eleven species were found only in biotopes from 1 to 10 ha.

At low-disturbed biotope, sixteen species of birds used sites of up to 1ha (n=18), 20 species from 1 to 10ha (n=18), and 12 species in the sites larger than 10ha (n=3). Also, five species were found only in biotopes from 1 to 10 ha.

If we compare these two areas, the occurrence of species which is familiar in urban areas is higher at high-disturbed biotope. Also, waterbird was observed at this biotope. The reason in occurrence of these species is that water resources are more common at high-disturbed biotope than low-disturbed biotope.

Dendrocopos kizuki, Dendrocopos major, Phylloscopus proregulus, Aegithalos caudatus, Oriolus chinensis etc. were observed at low-disturbed biotope, because diversity of vertical landscape in low-disturbed biotope was richer than high-disturbed biotope in areas surveyed.

Bird diversity increasing rate at Low-disturbed biotope is higher than high-disturbed biotope if area accumulation factor is taken into account (Fig. 3-1). More variety of vertical landscape at low-disturbed biotope seems to be affecting bird diversity.



<Figure 3-1> Cumulative number of species versus cumulative patch area

<Table 3-1> Surveyed area comparison with patch size.

	Patch size (ha)	Number of patch	Total area	Avg. area	Min. area	Max. area
High-disturbed biotope	> 10	3	70.89	23.63	17.93	31.90
	1~10	27	83.87	3.11	1.02	7.38
	< 1	5	2.24	0.45	0.34	0.58
	Total	35	157.01			
Low-disturbed biotope	> 10	3	73.83	24.61	20.21	32.06
	1~10	18	54.17	3.01	1.00	6.21
	< 1	18	7.95	0.44	0.15	0.80
	Total	39	135.96			

<Table 3-2> Bird diversity variation with patch size.

	Patch size (ha)	Number of patch	Total No. species	Avg. No. species	Min. No. species	Max. No. species
High-disturbed biotope	> 10	3	6	4.7	4.0	6.0
	1~10	27	18	3.3	1.0	10.0
	< 1	5	2	1.0	0.0	2.0
	Total	35	18			
Low-disturbed biotope	> 10	3	12	6.0	3.0	11.0
	1~10	18	20	4.8	1.0	9.0
	< 1	18	16	3.8	1.0	7.0
	Total	39	23			

Ⅳ. Discussion

1. Distribution of birds associated with habitat feature.

Our results indicated that low-disturbed biotope's environment is more suitable for birds' habitation than high-disturbed biotope. Because of that high-disturbed biotope is surrounded by artificial patches such as buildings and roads but low-disturbed biotope is surrounded by semi-natural patches such as farmland and forests. Urban development can impact birds indirectly through human activities. Traffic, noise pollution, and the presence of humans can cause birds to avoid urban developments. Birds take flight, or "flush" when humans are nearby, which may result in nest abandonment (e.g. Hockin et al., 1992) or an energetic cost through increased metabolic rate (Gabrielson and Smith, 1995). Consequently, human disturbance has been reported to adversely influence bird survival and reproduction (Foppen and Reijnen, 1994; Reijnen and Foppen, 1994). Due to these negative factors, we can conclude that the bird diversity at high-disturbed biotope is less variable than low-disturbed biotope.

Birds are quite sensitive to changes in habitat structure and composition and are therefore excellent indicators of changes and stresses in the urban ecosystem (Savard and Falls, 1982; Clergeau et al., 1998).

Several urban studies have shown that many recorded bird species have low densities and limited distribution in urban areas (Mills et al., 1989; Blair, 1996; Germaine et al., 1998). Also, many of these species may not be able to exploit urban environments and are relatively absent from urban areas because necessary habitat variables are unpresent. In this study, the bird diversity shows low density and limited distribution just like normal city. Particularly, metropolitan areas have a documented impact on avian communities. Researchers have reported higher bird densities of only a few species in urban areas when compared to natural areas, species composition and diversity changes as the degree of urbanization increases (e.g. Woolfenden and Rohwer, 1969; Emlen, 1974; Walcott, 1974; Degraaf and Wentworth, 1981; Blair, 1996). In this paper, the high density showed up in *Passer montanus, Pica pica*, and the tendency like this is more clear in more exploited site.

Studying the increase of bird diversity variation with respect to habitat size, most of species appeared in size (1-10ha), rather than in size (<1ha, >10ha). These results are different from previous study in Seoul. For example, park et al.(2002) suggested that the number of species was significantly correlated with the area. However, they worked in urban woods as forest and park. We can expect different bird diversity in urban areas due mainly to differences in local features.

Table 3-3. The occurrence rates of observed species with the each of area

No.	Scientific name	High-disturbed Area			Low-disturbed Area		
		<1 ha	1-10 ha	> 10 ha	<1 ha	1-10 ha	> 10 ha
1	*Egretta alba modesta**						0.33
2	*Anas platyrhynchos**		0.04				
3	*Anas poecilorhyncha**		0.07				
4	*Phasianus colchicus*				0.06	0.06	
5	*Gallinula chloropus**		0.04				
6	*Streptopelia orientalis*	0.20	0.04		0.17	0.28	0.67
7	*Picus canus*				0.06	0.11	
8	*Dendrocopos major*				0.06		
9	*Dendrocopos kizuki*					0.17	
10	*Hirundo rustica*		0.04			0.06	
11	*Motacilla alba leucopsis**		0.04				
12	*Hypsipetes amaurotis*		0.26			0.28	0.33
13	*Phoenicurus auroreus*		0.07			0.06	
14	*Urosphena squameiceps*					0.06	
15	*Phylloscopus proregulus*				0.06	0.06	
16	*Paradoxornis webbiana*		0.11	0.67	0.17	0.06	0.67
17	*Aegithalos caudatus*				0.06	0.11	0.33
18	*Parus palustris*		0.22	0.67	0.50	0.61	0.33
19	*Parus ater*		0.04		0.06	0.17	
20	*Parus varius*					0.06	
21	*Parus major*		0.41	1.00	0.72	0.78	0.33
22	*Emberiza rustica*		0.04		0.06	0.11	
23	*Emberiza elegans*		0.11	0.33	0.17	0.17	0.33
24	*Passer montanus*	0.80	0.96	1.00	0.78	0.78	1.00
25	*Sturnus cineraceus*		0.04				
26	*Oriolus chinensis*				0.06		0.33
27	*Garrulus glandarius*		0.04		0.06	0.11	0.33
28	*Pica pica*		0.74	1.00	0.72	0.72	1.00
	* : waterbirds are marked with an asterisk						
No. of species		2	18	6	16	20	12
No. of sites		5	27	3	18	18	3

We do not suggest that any of the bird species we observed maintain viable populations in the small patches, and some may not attempt to breed there. The sharp increase in cumulative species richness in Fig. 2 suggests that small patches are used on a daily basis by many species. As such, they have important values other rather than providing breeding areas (Fischer and Lindenmayer, 2002).

2. Urban planning and management implications

Species diversity and abundance are often related to the quality of urban life (Adams, 1994; Middleton, 1994).

Diversity of vertical landscape is also required for high-disturbed biotope within urban areas. Collocation of special made houses for species which are making holes in trees for their living shall be considered. Even if it is a fact that a variety of birds are observed at low-disturbed biotope rather than high-disturbed biotope, it is expected that with new construction in wetland, we can predict possibility of an increase in the number of various birds in high-disturbed biotope. In addition, site-specific actions such as shrub and tree planting, water restoration and increasing vegetation diversity can change bird diversity in the urban and improve the quality of human-wildlife contacts (Clergeau et al, 2001). Because the occurrence rate of bird is higher as forest is located nearby, a high number of various birds would be expected by establishing a network between low-disturbed biotope and high-disturbed biotope. Some birds and flying insects need a set of suitable neighbouring patches to disperse (Peterson, 1985; Opdam, 1990). Therefore, surrounding habitat features may affect bird community structures (Andrn, 1994; Jokimäki, 1999), and bird diversity in urban areas has been linked to periurban landscapes (Siegfried, 1968; Jones, 1983). Also, well-vegetated residential areas constitute aerial corridors through their tree canopy. Such corridors are especially useful for migrating birds which birds use them extensively as they provide food and protection against aerial predators (Savard, 1978). Alternately, It would be a good alternative plan to locate small habitats or high-disturbed biotopes within urban areas so birds can use them as stepping stones during migration or movement.

Studying the increase of bird diversity variation with respect to habitat size, most of species appeared in size (1-10ha), rather than in size (<1ha, >10ha). We think that this habitat size is the actual area to promote bird diversity within the urban area.

Especially in Seoul, it is important to decide the habitat size considering an increase of land prices and density of population, therefore, Creation and strategic location of small habitat such as high-disturbed biotope within urban areas to make a efficient network of habitat would be much helpful to increase bird diversity.

It is considered that small habitat with multiple vegetation structure can provide bird shelter and play a role as corridors for dispersion. In addition, due to their lower costs, small scale restoration programmes using small patches as a starting point are more likely to be implemented in the short term than large scale projects that can be very expensive (Fenton, 1997).

Therefore, from a policy perspective on how to manage urban sites for birds, it would be useful to know whether land use can predict whether a given area is attractive to a particular species. Such information will give pertinent information to homeowners, developers, landscape architects, and city planners to evaluate whether a piece of property could be designed for a given bird species.

Ⅴ. Conclusion

Our study is summarized as follows :

1) Due to intervention caused by human being, bird diversity is being affected at the places studied.

2) The rate of increase in the bird diversity with area at low-disturbed biotope is higher than high-disturbed biotope according to the research carried out.

3) To protect and improve the diversity at urbanized areas, a special biotope management is required. If water resources and diversity of vertical landscape is maintained, even small area can be helpful to the bird diversity promotion.

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초록

서울시의 조류다양성 증진을 위한 도시비오톱 특성 분석

채진확 ·구태회

주요단어 : 조류다양성, 정주지 비오톱, 서식지 크기, 산림지 비오톱, 출현율

서울시를 대상으로 도시 비오톱의 서식특성을 분석하기 위해 대상지를 정주지 비오톱과 산림지 비오톱으로 구분하여 서식지 특성에 따른 조류다양성 변화를 살펴보았다. 이들의 구분은 불투수포장비율과 인간의 간섭정도에 따라 구분하였다. 정주지 비오톱(n=35)에서 18종의 조류가 관찰되었으며 전체면적은 157.01ha이다. 또한, 산림지 비오톱(n=39)은 23종의 조류가 관찰되었으며 전체면적은 135.96ha이다. 전체 대상지에서 전반적으로 참새와 까치 등 도심에서 흔히 접할 수 있는 조류의 출현빈도가 높게 나타났다. 특히 정주지 비오톱에서 도심성 조류의 출현빈도가 높았으며 수동에 서식하는 딱다구리와 산림성 조류인 노랑허리솔새, 오목눈이, 꾀꼬리 등은 산림지 비오톱에서만 관찰되었다. 종-면적 축적곡선을 살펴보면 산림지 비오톱이 정주지 비오톱보다 조류의 증가율이 높게 나타났다. 그리고 서식지 크기에 따른 조류다양성의 변화를 살펴보면, 대부분의 조류들이 1-10ha에서 관찰되었다. 이렇듯 불투수포장비율이 높은 비오톱에서 조류다양성이 낮게 나타났으며 이를 보안하기위해 정주지 비오톱 및 작은 면적의 서식지를 중심으로 도시지역에서 조류의 다양성 증진을 위해 비오톱 네트워크화가 요구되어진다. 또한 도심 내에서 조류다양성 증가를 위해 각 대상지의 수직적 경관구조의 다양성이 요구되어지며 정주지 비오톱을 징검돌로 활용하는 방안이 마련되어져야 할 것이다.

Appendix 1. Surveyed sites (high-disturbed biotope)

No.	Survey site (administrative section)	biotope pattern	No. species	Area (ha)	Impermeable pavement ratio
1	Bangi-dong, Songpa-gu	RAB	1	0.41	26.16
2	Bongcheon 1-dong, Gwanak-gu	RAB	2	0.58	85.00
3	Mangu 1-dong, Jungnang-gu	RAB	2	1.02	95.00
4	Hongeun 3-dong, Seodaemun-gu	RAB	8	1.36	95.00
5	Dunchon-dong, Gangdong-gu	RAB	3	1.36	60.00
6	Ssangmun 1-dong, Dobong-gu	RAB	4	1.73	26.16
7	Sangil-dong, Gangdong-gu	RAB	2	1.79	60.00
8	Daechi 3-dong, Gangnam-gu	RAB	1	2.04	80.00
9	Sanggye 4-dong, Nowon-gu	RAB	6	2.29	50.00
10	Bangbae 4-dong, Seocho-gu	RAB	4	2.42	88.00
11	Jamsil dong, Songpa-gu	RAB	5	2.84	65.00
12	Gaepo 2-dong, Gangnam-gu	RAB	5	3.57	80.00
13	Gaepo 3-dong, Gangnam-gu	RAB	3	5.35	55.00
14	Siheung 3-dong, Geumcheon-gu	RAB	2	5.85	91.00
15	Sanggye 6-dong, Nowon-gu	RAB	3	6.04	80.00
16	Gaepo Jugong Apts. 1, Gangnam-gu	RAB	6	6.26	65.00
17	Gaepo-dong, Seocho-gu	RAB	4	17.93	85.00
18	Macheon-dong, Songpa-gu	TFB	0	0.50	90.00
19	Gaebong-dong, Guro-gu	TFB	1	1.80	0.00
20	Hwayang-dong, Gwangjin-gu	TFB	4	3.47	85.00
21	Segok-dong, Gangnam-gu	TFB	4	21.06	20.00
22	Jung-dong, Mapo-gu	IUB	1	0.34	90.00
23	Chang 4-dong, Dobong-gu	IUB	1	0.41	90.00
24	Munjeong 2-dong, Songpa-gu	IUB	2	1.33	50.00
25	Jamsil 5-dong, Songpa-gu	IUB	2	1.62	40.00
26	Sangam-dong, Mapo-gu	IUB	2	1.98	70.00
27	Guro-dong, Guro-gu	IUB	1	2.72	0.00
28	Sillim 9-dong, Gwanak-gu	IUB	2	2.72	48.00
29	Cheonwang-dong, Guro-gu	IUB	2	4.64	35.00
30	Mangwon 2-dong, Mapo-gu	IUB	10	6.18	25.00
31	Irwon-dong, Gangnam-gu	IUB	6	31.90	85.00
32	Hongeun 1-dong, Seodaemun-gu	CBB	1	1.44	95.00
33	Bulgwang 1-dong, Eunpyeong-gu	CBB	3	2.20	50.00
34	Jamsil 6-dong, Songpa-gu	CBB	1	2.48	90.00
35	Samseong 2-dong, Gangnam-gu	CBB	3	7.38	90.00

Biotope pattern : Residential Area Biotope (RAB), Commercial or Business Area Biotope (CBB), Industrial or Urban Infrastructure Facilities Area Biotope (IUB), Transportation Facilities Biotope (TFB)

Appendix 2. Surveyed sites (Low-disturbed biotope)

No.	Survey site (administrative section)	biotope pattern	No. specie	Area (ha)	Impermeable pavement ratio
1	Macheon 2-dong, Songpa-gu	FLB	3	0.15	0.00
2	Dobong-dong, Dobong-gu	FLB	3	0.29	0.00
3	Dongjak-gu	FLB	4	0.46	0.00
4	Irwon-dong, Gangnam-gu	FLB	3	0.51	0.00
5	Sugung-dong, Guro-gu	FLB	6	0.53	0.00
6	Cheonwang-dong, Guro-gu	FLB	3	0.66	0.00
7	Jingwanoe-dong, Eunpyeong-gu	FLB	3	1.20	0.00
8	Sinjeong-dong, Yangcheon-gu	FLB	5	2.14	0.00
9	Macheon-dong, Songpa-gu	FLB	1	2.40	0.00
10	Dunchon-dong, Gangdong-gu	FLB	3	2.55	0.00
11	Dobong-dong, Dobong-gu	FLB	6	3.13	0.00
12	Naegok-dong, Seocho-gu	FLB	9	3.53	0.00
13	Sinnae 1-dong, Jungnang-gu	FLB	3	5.48	0.00
14	Godeok 2-dong, Gangdong-gu	FLB	4	21.56	0.00
15	Magok-dong, Gangseo-gu	FLB	3	32.06	0.00
16	Yeonji, Guro-gu	FRB	5	0.18	0.00
17	Amsa-dong, Gangdong-gu	FRB	6	0.19	0.00
18	Chang 3-dong, Dobong-gu	FRB	3	0.35	0.00
19	Beon 3-dong, Gangbuk-gu	FRB	6	0.42	0.00
20	Samseong-dong, Gangnam-gu	FRB	4	0.50	0.00
21	Gaepo 4-dong, Gangnam-gu	FRB	7	0.56	0.00
22	Beon 2-dong, Gangbuk-gu	FRB	3	0.63	0.00
23	Mangu 3-dong, Jungnang-gu	FRB	8	1.00	0.00
24	Irwon-dong, Gangnam-gu	FRB	5	1.60	0.00
25	Namhyeon-dong, Gwanak-gu	FRB	9	2.01	0.00
26	Suyu 5-dong, Gangbuk-gu	FRB	5	3.03	0.00
27	Mia 2-dong, Gangbuk-gu	FRB	5	6.21	0.00
28	Ssangmun 1-dong, Dobong-gu	FRB	11	20.21	0.00
29	Beon-dong, Gangbuk-gu	LGB	3	0.19	0.00
30	Hail-dong, Gangdong-gu	LGB	3	0.23	0.00
31	Bon-dong, Dongjak-gu	LGB	3	0.50	0.00
32	Garak-dong, Songpa-gu	LGB	1	0.80	0.00
33	Gaepo-dong, Gangnam-gu	LGB	2	0.80	0.00
34	Segok-dong, Gangnam-gu	LGB	5	1.01	0.00
35	Jangan-dong, Dongdaemun-gu	LGB	2	1.23	0.00
36	Ancient Baekje-era Tombs, Songpa-gu	LGB	6	2.85	0.00
37	Paris Park, Gangseo-gu	LGB	4	2.96	0.00
38	Yeongdeungpo Park, Yeongdeungpo-gu	LGB	2	5.74	0.00
39	Deoksugung, Jung-gu	LGB	5	6.10	0.00

Biotope pattern : Landscape or Green Area Biotope (LGB), Farmland Biotope (FLB), Forest Biotope (FRB)