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연구노트

Distribution of Riparian Vegetation in a Small Stream (Ian Stream), South Korea

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이안천의 식생분포 특성

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Abstract

소하천의 식생분포특성을 조사하기 위하여 경북 상주시 내서면 서원리에서 낙동강 본류가 만나는 함창읍 신흥리까지 이안천의 약 25km 구간에서 7개의 정점을 선정하였다. 각 조사정점에서 상 · 하 약 1.5km 구간에 대하여 식물상 및 식생분포현황을 중점조사 하였다. 7개 조사정점에서 출현한 식물은 모두 49과 54속 145종 12변종 1품으로 도합 158종류가 확인되었다. 출현 식물 중 한국 특산식물인 환경부 1등급종 쥐방울덩굴, 물오리나무, 왕버들, 낙지다리 4종류가 출현하였다. 17종류가 출현하였으며 귀화율은 10.8%, 도시화지수는 6.1%로 나타났다.

식생도상에 표시된 식생유형을 경관생태학적으로 분석하기위하여 식생유형별 조각수를 비교하였다. 이안천의 전체 조사정점의 식생 조각 수는 183개로 나타났으며, 육상식물인 명아주군락을 제외한 수변군락의 식생수는 총 181개로서 전체의 98.9%를 나타내었다. 군락별로는 달뿌리풀군락이 76개로서 전체의 42.5%로서 가장 높고, 갯버들군락이 67개로서 35.8%, 삿갓사초가 26개로서 26.0%, 고마리가 3개로서 1.1%를 나타내었다. 각 조사지점별 식생면적의 구성비에서도 달뿌리풀이 가장 높고, 갯버들, 삿갓사초의 순으로 나타났다.

주요어 : 이안천, 식생분포, 식물상

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I. Introduction

There has been growing interest in riparian vegetation structure, composition, and dynamics in the past decade (Malanson, 1993 and Nilsson *et al*., 1994). Riparian systems are aquatic-terrestrial ecotones with unique biotic, biophysical, and landscape characteristics (Naiman and Decamps, 1997 and Wiens, 2002). Riparian plant communities perform an array of important ecosystem functions, including stream bank stabilization , thermal regulation of streams, filtering and retention of nutrients (Vought *et al*., 1994), provision of critical wildlife habitat, and maintenance of ecosystem stability (Wiens *et al*., 1985). Given the unique attributes of riparian vegetation, characterizing their composition and structure is an integral component of riparian protection and conservation efforts (Naiman and Decamps, 1997). Vegetation in riparian zones commonly occurs amidst a diverse mosaic of landforms, communities, and environments within the larger landscape (Wiens, 2002). Riparian plant communities are typically composed of specialized and disturbance-adapted species within a matrix of less specialized and less frequently disturbed plant species (Naiman *et al*., 1998).

The complex vegetation and plant species distributions within riparian corridors influence plant species diversity patterns at both the local and regional scales and reflect both anthropogenic and natural disturbances. Because of these characteristics, riparian zones are often the ecosystem components that are most sensitive to changes within the surrounding environment, and as such, provide early indications of environmental change (Decamps, 1993) and can be viewed as the focal point of watersheds (Naiman and Decamps, 1997).

One key disturbance that influences riparian systems is the invasion of non-native plant species, many of which have been shown to significantly affect the composition and diversity of native plant communities (Lodge, 1993). Several interactive processes appear to control the establishment and spread of non-native species in riparian systems (Decamps *et al*., 1995). Riparian corridors may be especially susceptible to invasion due to the substantial environmental heterogeneity created by the moderate flooding that occurs naturally in these systems (Naiman and Decamps, 1997).

The objectives of this study were to : (1) document the composition and dominance of plant communities of riparian areas in the Ian Stream, and (2) compare the species composition and diversity in seven sites in Ian Stream riparian areas.

1. STUDY AREA

The Ian Stream is located in Usan-ri, Oeseo-myeon, Sangju-si. It flows from the point about 4 km upstream from the mainstream of the Yeong River, which is the first branch of the Nakdong River, into the right bank of the Yeong River. The Ian Stream's drainage basin area is 241.76 km^2 its water course length, 52.3 km; its average rainfall per year, 1,213 mm; and its average inflow, 48.8 ms m^3/year (Korea Water Resources Corporation, 2004). Seven points were selected within a 25km section from Seowon-ri, Naeseo-myeon, Sangju-si, Gyeonsangbuk-do to Sinheung-ri in Hamchang-eup, where the main stream meets the branch. These points are shown in Figure 1.

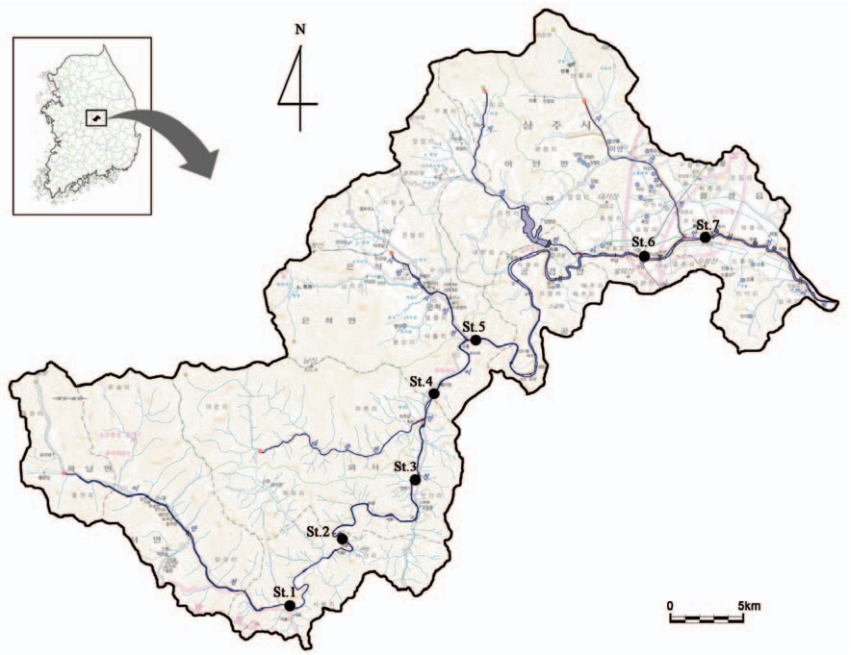

Figure 1. Map of the riparian vegetation investigation sites in the Ian Stream

II. Methods

The field data collection was performed from April to November 2005. The riparian vegetation was quantified by analyzing the streambank within about 1.5 kms in each site along the Ian Stream. A floristic survey was conducted across each site, and all the observed species were recorded until no more new species were found. The authors wanted to determine if and how the disturbance level in the riparian corridor, as defined by the existing land cover, might be influencing patterns of both native and non-native species.

A transect was the recommended sampling method in communities that were thought to be strongly influenced by an environmental gradient. The percent cover of each species was calculated for the plot as the mean cover recorded from all the subplots. Species fidelity was defined as the number of plots in which each species occurred divided by the total number of plots.

III. Results and Discussion

There were 49 families, 54 genera, 145 species, 12 varieties, and 1 forma, or a total of 158 kinds, of vascular plants (Table 1 and Figure 2).

The dominant vegetation communities were the *Phragmites japonica*, *Salix gracilistyla*, *S. hulteni*, and *Robinia pseudo-acacia* communities that were distributed in the riparian area. The *Persicaria sieboldii*, *Stellaria alsine* var. *undulata*, *Draba nemorosa* var. *hebecarpa*, *Capsella bursa-pastoris*, *Lepidium apetalum*, *Bidens frondosa*, *Trigonotis peduncularis*, and *Hemistepta lyrata* communities, which are annual or herbaceous species, were distributed in sandbank or riparian areas. *Equisetum arvense*, *Humulus japonicus*, *Persicaria perfoliata*, *Trifolium repens*, *rtemisia princeps* var. *orientalis*, *Lactuca indica* var. *laciniata*, *Avena fatua*, *Agropyron yesoense*, *Oenothera odorata*, *Viola mandshurica*, and *Rumex crispus* appeared mainly in bank sides.

Table 1. Different appearance flora of investigation sites in Ian stream

Site	Family	Genera	Species	Var.	For.	Total	Exotic plants
S1	43	85	95	7	-	103	9
S2	30	75	85	7	-	92	14
S3	27	56	72	5	-	77	10
S4	24	54	62	7	1	70	12
S5	25	52	61	7	-	68	9
S6	25	54	58	7	-	65	10
S7	23	51	54	6	-	60	10
Total	49	54	145	12	1	158	17

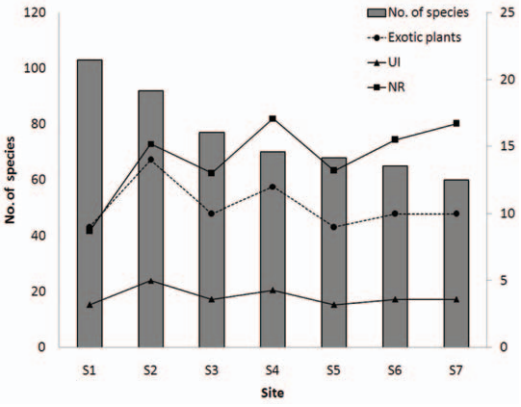

Figure 2. Spatial distribution of Urbanization index(UI), naturalized ratio(NR) and number of exotic plants(EP) in Ian stream

1. Specific and Naturalized Plants

There was a total of 4 taxa of specific plant species by floral region. *Aristolochia contorta* was distributed in the S4 bank site; *Salix grandulosa* appeared in all areas except for S2 and S4 *Alnus hirsuta* appeared in bank sides in S2 and S3, which were mainly in the middle part of Korea; and *Penthorum chinense* were unique in S1.

In case the recent classification system of 280 kinds of plants (Koh *et al*., 2002) was applied to the naturalized plants, the naturalization rate was 10.8%; higher than the average naturalization rate (NR) of Korea's country mountain district (10.3%) (Lee and Jeon, 1995), and the urbanization index (UI) was 6.1% (Table 2 and Figure 2).

2. Vegetation

Physiognomical vegetation mapping was done for each site in the Ian Stream. The number of vegetation pieces was compared to the landscape ecology in each site. There were 183 vegetation pieces in all seven sites, 181 of which (98.9%) were from riparian vegetation communities, and the rest, from land plant communities (Table 3).

Among the communities, the *Phragmites japonica* community occupied the widest area (42.5%, 76 pieces), followed by the *Salix gracilistyla* community (35.8%, 67 pieces), the *Carex dispalatacommunity* (26.0%, 26 pieces), and the *Persicaria thunbergii* community (1.1%, three pieces). The *Rumax crispus*, *Veronica anagallis-aquatica*, *Persicaria sieboldii*, and *Phragmites japonica - Carex dispalata-communities* each appeared only one time.

Table 2. Urbanization index(UI), naturalized ratio(NR) and exotic plants of investigation sites in Ian stream

Site	S1	S2	S3	S4	S5	S6	S7	Total
Total number of plants	103	92	77	70	68	65	60	158
No. of exotic plants	9	14	10	12	9	10	10	17
UI	3.2	5.0	3.6	4.3	3.2	3.6	3.6	6.1
NR	8.7	15.2	13.0	17.1	13.2	15.5	16.7	10.8

Table 3. Distribution of Landscape vegetation(%) and number of vegetation piece of investigation sites in Ian stream (parenthesis: vegetation number of piece)

Community	St.1	St.2	St.3	St.4	St.5	St.6	St.7	ratio
Phragmites japonica	50.9(9)	23.1(14)	50.8(14)	35.5(13)	55.4(9)	63.2(5)	83.1(12)	49.51(42.5)
Salix gracilistyla	30.3(8)	42.5(16)	42.9(15)	26.6(10)	23.3(4)	36.8(10)	5.0(4)	28.68(35.8)
Carex dispalata	12.9(10)	7.0(7)	6.2(2)	16.4(6)	8.2(2)	-	-	6.88(14.5)
Phalaris arundinacea	3.5(1)	-	-	-	13.2(2)	-	-	1.94(1.7)
Chenopodium album var. *centrorubrum*	0.6(1)	-	-	-	-	-	1.8(1)	0.48(1.1)
Persicaria thunbergii	0.4(2)	0.3(1)	-	-	-	-	-	0.15(1.1)
Rumax crispus	0.6(1)	-	-	-	-	-	-	0.09(0.6)
Veronica anagallis-aquatica	0.3(1)	-	-	-	-	-	-	0.04(0.6)
Persicaria sieboldii	0.3(1)	-	-	-	-	-	-	0.04(0.6)
Phragmites japonica-Carex dispalata	-	-	-	21.5(1)	-	-	-	2.01(0.6)
Physical park ect.	-	-	-	-	-	-	10.2(1)	2.26(0.6)
Arable land	-	27.1(1)	-	-	-	-	-	7.92(0.6)
Total	100.0(34)	100.0(38)	100.0(31)	100.0(30)	100.0(17)	100.0(15)	100.0(18)	100.0

IV. Conclusion

This study of the vegetation of the Ian Stream showed that the dominant communities are the *Phragmites japonica* community and the *Salix gracilistyla* community. The area occupied by the *Phragmites japonica* per unit area was larger in the wider stream section and the lower reaches. The composition ratio of the *Salix gracilistyla* was higher in the upper reaches, and the area it occupied was smaller in the lower reaches. The *Carex dispalata* community and the *Phalaris arundinacea* community occupied smaller areas per unit area in the lower reaches (Figure 3). These results show the general characteristics of the middle sections of streams in Korea(Song *et al.*, 1996), and that the Ian Stream has a relatively low disturbance and keeps its natural quality.

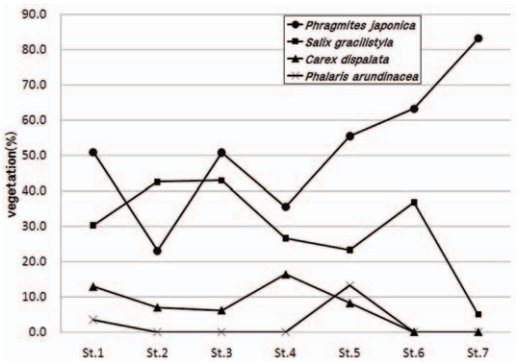

Figure 3. Distribution of Landscape vegetation(%) in Ian stream

References

Decamps, H., 1996. The renewal of floodplain forests along rivers: a landscape perspective. *Verh. Int. Verein. Limnol.*, 26, 36-59.

Koh Kangsuk, Minhwan Suh, Jihyun Kil, Younbong Ku, Hyunkyung Oh, Sanguk Suh Soohyun Park, and Younghoan Yang, 2002, Research on the Effects of Alien Plants on Ecosystem and Their Management (III). *Report of NIER*, 24, 121-133.

Korea Water Resources Corporation, 2004, A study on the Ecological and Environmental Restoration for Streams. 1-86.

Lodge, D. M., 1993, Biological invasions: lessons for ecology. *Trends Ecol. Evol.*, 8, 133-137.

Malanson, G. P., 1993, Riparian Landscapes. Cambridge University Press, Cambridge.

Naiman, R. J. and Decamps, H., 1997, The ecology of interfaces: riparian zones. *Ann. Rev. Ecol. Systemat.*, 28, 621-658.

Naiman, R. J., Fetherston, K. L., McKay, S., and Chem, J., 1998, Riparian forests. In: Naiman, R. J., Bilby, R. E. (Eds.), River Ecology and Management: Lessons from the Pacific Coastal Region. Springer-Verlag, New York, pp. 289-323.

Nilsson, C., Ekblad, A., Dynesius, M., Backe, S., Gardfjell, M., Carlberg, B., Hellqvist, S., and Jannson, R., 1994, A comparison of species richness and traits of riparian plants between a main river channel and its tributaries. *J. Ecol.*, 82, 281-295.

Song, Jong-Suk and Seung-Dal Song, 1996, A Phytosociological Study on the Riverside Vegetation around Hanchon, an Upper Stream of Nak-tong River. *Korean J. Ecol.*, 19(5), 431-451.

Vought, L. B. M., Dahl, J., Pederson, C. L., and Lacoursiere, J. O., 1994, Nutrient retention in riparian ecotones. *Ambio*, 23, 342-348.

Wiens, J. A., Crawford, C. S., and Gosz, J. R., 1985, Boundary dynamics: a conceptual framework for studying landscape ecosystems. *Oikos*, 45, 421-427.

Wiens, J. A., 2002, Riverine landscapes: taking landscape ecology into the water. *Freshw. Biol.*, 47, 501-515.

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