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On the Dominance-Diversity in the Forest Vegetation of Mt. Seolag

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설악산 삼림식생의 우점도 다양성에 관하여

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ABSTRACT

A study on the dominance-diversity of forest vegetation in Mt. Seolag was conducted from May 1981 to Aug. 1983.

Based on the field data, the dominance-diversity curves were made for 16 sites including slopes and vallies. The curves are grouped in two types, lognormal distribution at the sites of mature vegetation and geometric series at the disturbed or rocky sites. It seems that the curves express the nature of their ecocline, by the hypotheses of some investigators, i.e. Random Niche hypothesis, Niche Pre-emption hypothesis, Lognormal distribution and Logarithmic series. The dominance concentration among the southern, northern and western slope of Daecheong bong are compared with Shannon's index, H'. H'=1.442 at northern slope, H'=1.282 at southern slope and H'=1.385 at western slope. Dominance-diversity curves of 16 sites showed Preston's lognormal distribution with small variations among them. It seems that the dominance diversity reflects on the differences in the coenocline of their sites.

The top 10 dominant species in species sequence of 113 tree species in whole the mountain, were noticed: *Quercus mongolica*, *Pinus densiflora*, *Acer pseudo-siebold anum*, *Quercus serrata*, *Carpinus laxiflora*, *Styrax obassia*, *Fraxinus rhynchophylla*, *Tilia amurensis*, *Lindera obtusiloba* and *Abies holophylla* in order.

INTRODUCTION

Mt. Seolag National Park, located in northern part of the Taebaek Mountains in Korean Peninsula, was appointed as the nature reserve area by the UNESCO for the Man and Biosphere Project (MAB).

From the mountain foot to its top (1,708m), a series of change in dominant species along vegetational changes, summer broad-leaved deciduous forest (northern and middle

part of the cool temperate zone) and evergreen needle forest (subarctic zone), are recognized (Yim 1977). There are 854 species of vascular plants and 9 plant communities (The Ministry of Education, 1967, Lim *et al.*, 1983, Baek and Yim, 1983).

According to Curtis and McIntosh (1951), the importance value of different species in a community can be used for a measure of physical environment, structure and function of the community. Four types of dominance diversity or relative abundance curves have been recognized and the hypotheses interpreting those types have also been presented; Random Niche hypothesis (MacArthur, 1961, Whittaker, 1965, 1970, 1972, 1975), Niche Pre-emption hypothesis (Motomura, 1932, Whittaker, 1965, 1970, 1972, 1975), Lognormal distribution (Preston, 1948, 1962) and Logarithmic series (Fisher *et al.*, 1943, Pielou, 1969).

This research was carried out to clear the dominant tree species distributed in the area and to examine the above mentioned hypotheses with dominance-diversity curves obtained from 16 sites selected, including slopes and vallies.

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MATERIALS AND METHODS

Vegetation survey. Mt. Seolag including several summits such as Daecheongbong (1,708 m), Socheongbong (1,560 m), Hwangcheolryeong (1,381 m), Guiddegibong (1,578 m), Galibong (1,519 m), Jeombongsan (1,424 m) and Ansan (1,430 m) etc. has a complicated topography due to many slopes and vallies. In order to simplify the complicated topography, the mountain area was divided into three parts: North-Eastern Seolag (the north-eastern area of Misiryeong-Madeungryeong-Daecheongbong-Gwanmobong line), North-Western Seolag (the north-western area of Ansan-Daesungryeong-Giddegicheongbong line) and Southern Seolag (the southern area of Mt. Seolag) (Fig. 1 and Table 1).

By the topography of three parts, 16 sites were selected as sample site. The data of 300 quadrats (10-30 quadrats at one site) was obtained from May 1981 to Aug. 1983. The dominant species in their quadrats were recorded and the density and basal area were calculated for DBH$\geqq$2cm trees.

Calculations of species importance and species diversity. The importance value of each tree species was calculated by Curtis and McIntosh (1951) and dominance-diversity curves at the different sites were depicted by Whittaker (1965) (Fig. 3 and 4-a, b). Shannon's diversity index (H') was calculated with species dominance and Simpson's index of dominance concentration(C) was calculated with the importance value at the sites (Simpson, 1949, Shannon and Weaver, 1963). The percentage similarity (Ps) was calculated by Whittaker (modified from Whittaker, 1952, 1972) and the dendrogram by cluster analysis was made on different site (Mountford, 1962).

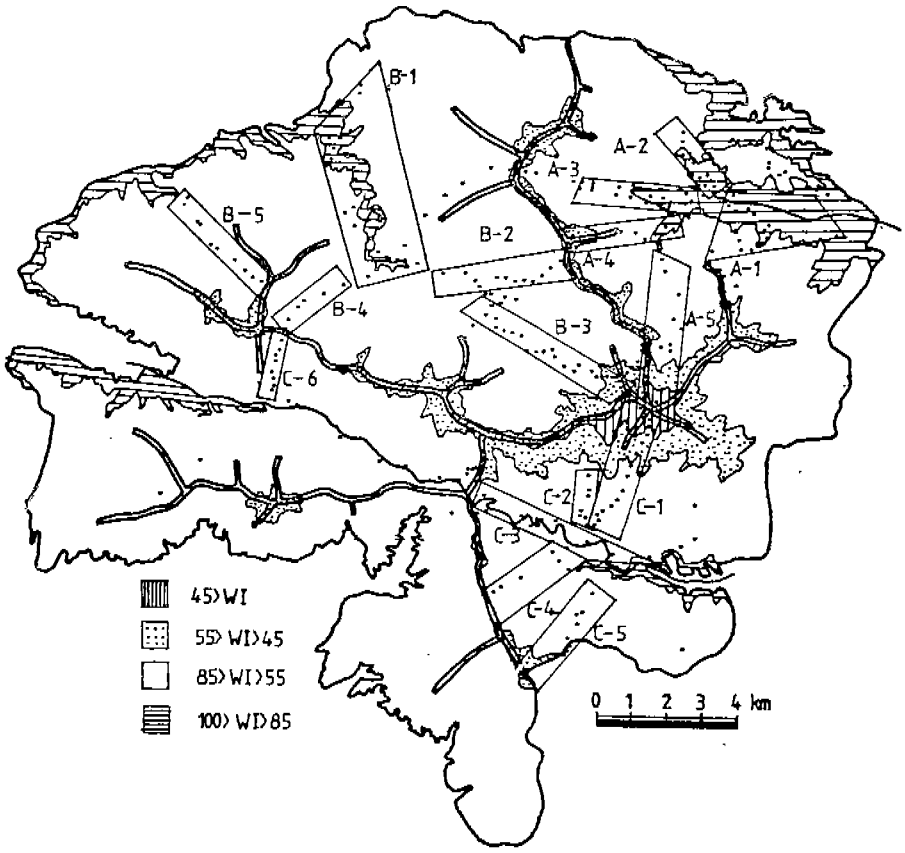

Fig. 1. Sample area of Mt. Seolag. For symbols, A, B and C see table 1. Close circle indicate sample plot. WI : warmth index (Yim and Kira, 1975).

Table 1. Dominance concentration values and diversity indices for slopes in Mt. Seolag

Slope No.	Direction	Altitude (m)	Sampling area(m^2)	Nos. of species	Nos. of individuals	DBH size class (%) 2-8	-16	-32	32-	Dominance concentration	Diversity index
A-1	E	180- 620	2250	36	614	57.0	29.6	11.4	2.0	.098	1.198
A-2	SE	200- 480	2125	27	417	60.9	19.9	13.4	5.8	.101	1.175
A-3	E	260- 550	4425	40	753	52.1	29.2	15.7	3.0	.105	1.231
A-4	E	250-1320	1950	33	373	58.4	24.1	10.5	7.0	.107	1.216
A-5	N	340-1630	1525	40	643	74.2	14.3	8.2	3.3	.055	1.442
B-1	NNW	400- 760	4050	39	1136	58.6	24.0	11.5	5.9	.117	1.355
B-2	W	670-1230	4100	41	840	49.4	24.0	17.9	8.7	.075	1.329
B-3	WNW	620-1660	4125	48	1001	59.0	24.0	12.6	4.4	.054	1.385
B-4	NE	560-1110	1750	41	466	53.4	25.6	16.5	4.5	.052	1.398
B-5	NW	500-1320	2425	43	589	55.2	22.1	15.4	7.3	.055	1.430

C-1	S S W	460-1600	2870	45	793	63.7	15.6	12.6	8.1	.093	1.282
C-2	S	490- 800	1200	37	310	58.1	22.3	14.8	4.8	.060	1.379
C-3	E S E	330- 930	2400	23	633	65.7	19.5	7.4	7.4	.100	1.106
C-4	E N E	400-1200	2175	41	669	63.8	26.2	8.5	1.5	.086	1.326
C-5	N E	400-1400	2525	29	469	42.2	23.5	26.4	7.9	.140	1.092
C-6	S S W	500-1210	1950	29	558	50.7	26.7	19.0	3.6	.164	1.123

RESULTS AND DISCUSSION

Among 113 tree species listed at sample sites, *Quercus mongolica* widely distributes in whole mountain (at 12 sites first rank). However, *Acer pseudo-siebal dianum* and *Tilia amurensis* at sites A-5 and C-1, *Abies holophylla* and *Pinus densiflora* at site B-3, *Pinus densiflora* in the disturbed area and *Quercus serrata* in the semidisturbed area are noticeable. *Carpinus laxiflora* distributes with relatively high freqnency at mesic and warm sites such as A-3, A-4, B-4 and C-2. The top 10 species in species sequence of whole mountain area were recorded; *Quercus mongolica*, *Pinus densiflora*, *Acer pseud-sieboldianum*, *Quercus serrata*, *Carpinus laxiflora*, *Styrax obassia*, *Fraxinus rhynchophylla*, *Tilia amurensis*, *Lindera obtusiloba* and *Abies holophylla* in order. The dominance-diversity curves at 16 sites and whole area are generally similiar to lognormal distribution by Preston (1948) with minor exceptions (Fig. 1, 3 and 4-a,b, Table 1). The differences of the dominance diversity curves among the southern (C-1), northern (A-5) and western slope (B-3) at Daecheongbong give us some idea to evaluate their site conditions. (Fig. 4-a, b). According to some investigators (Odum, 1960, Golley, 1965, Whittaker, 1970, 1972,

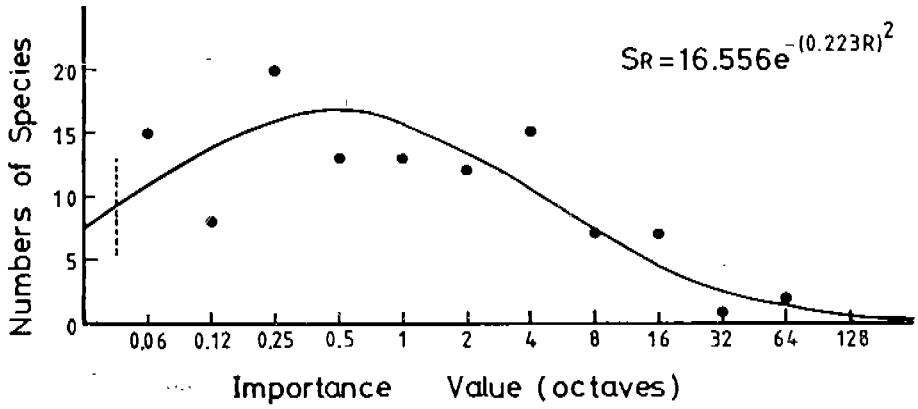

Fig. 2. The lognormal distribution of species importance value by Preston (1948) in Mt. Seolag. Points are numbers of species ploted against their importance value within the octaves of importance value. The dashed vertical line is the "veil line", to the left of which no data on species numbers and importance value are available.

Table 2. Percentage similarity (PS, Whittaker; 1952) between 16 slopes.

A-1	A-2	A-3	A-4	A-5	B-1	B-2	B-3	B-4	B-5	C-1	C-2	C-3	C-4	C-5	C-6	
1	.651	.540	.396	.419	.599	.453	.390	.380	.299	.294	.551	.582	.395	.435	.392	A-1
	1	.453	.379	.380	.473	.439	.387	.379	.355	.328	.525	.537	.419	.426	.397	A-2
		1	.343	.277	.566	.469	.384	.398	.291	.266	.612	.431	.299	.414	.397	A-3
			1	.561	.526	.614	.536	.535	.483	.616	.453	.665	.650	.638	.545	A-4
				1	.456	.506	.561	.559	.574	.707	.425	.604	.603	.425	.380	A-5
					1	.717	.481	.470	.451	.486	.616	.654	.494	.602	.552	B-1
						1	.632	.559	.502	.578	.622	.629	.542	.655	.606	B-2
							1	.513	.526	.578	.547	.530	.484	.504	.499	B-3
								1	.566	.550	.538	.502	.475	.431	.447	B-4
									1	.604	.440	.487	.619	.443	.480	B-5
										1	.396	.614	.574	.552	.532	C-1
											1	.552	.461	.477	.490	C-2
												1	.680	.650	.571	C-3
													1	.580	.483	C-4
														1	.745	C-5
															1	C-6

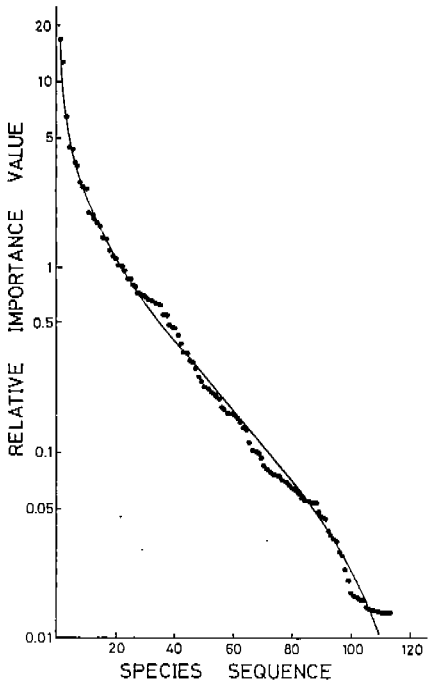

Fig. 3. Importance value curve in Mt. Seolag.

1975), a form of dominance-diversity curve showed steeply oblique curve approximating geometric series in early stage of succession or harsh physical environment and fitted lognormal distribution during succession with increase of species diversity. This suggestion will be useful for the evaluation of present study area.

The equation of Preston (1948), $Sr = Soe^{-(ar)^2}$, was applied for all the tree species in whole mountain and at different sites, and the X^2-test for fitness of the equation in their sites was generally showed the significance at 0.05 level in different freedom. But somewhat difference was recognized in lower range of importance value between the theoretical value and observed value. The species with high frequency in Preston's lognormal distribution curve showed, in general, the range of 1016 of importance value.

The form of the curve obtained from whole Mt. Seolag, $Sr=16.556e^{(-1.223R)^2}$, is similar to that of the shrub phase in Sonoran desert communities by Whittaker and Niering (1975). Such a mode may depends on the fact that the species with low importance value, DBH<2 cm tree species and herbaceous plants, are excluded in sampling (Fig. 2).

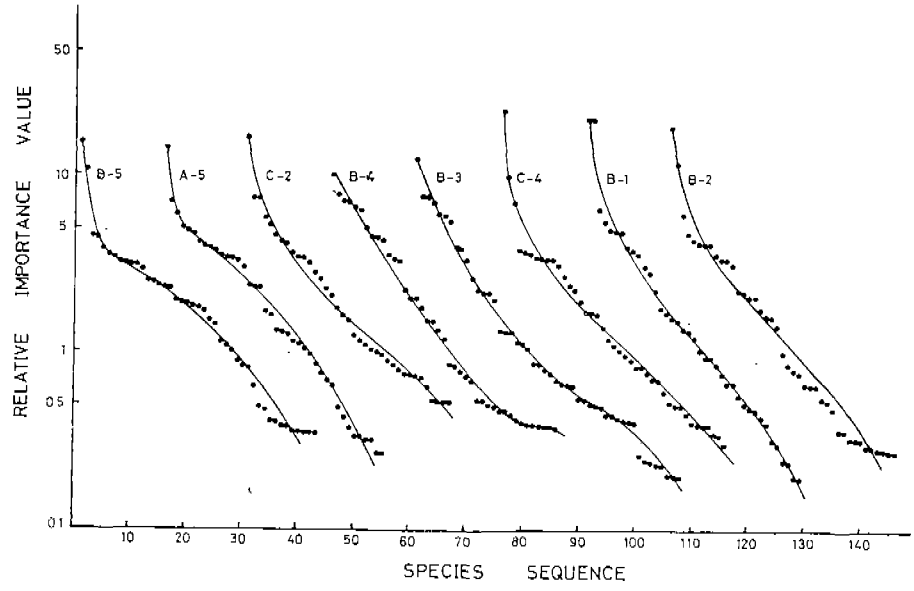

Fig. 4-a. Importance value curves for various slopes in Mt. Seolag.

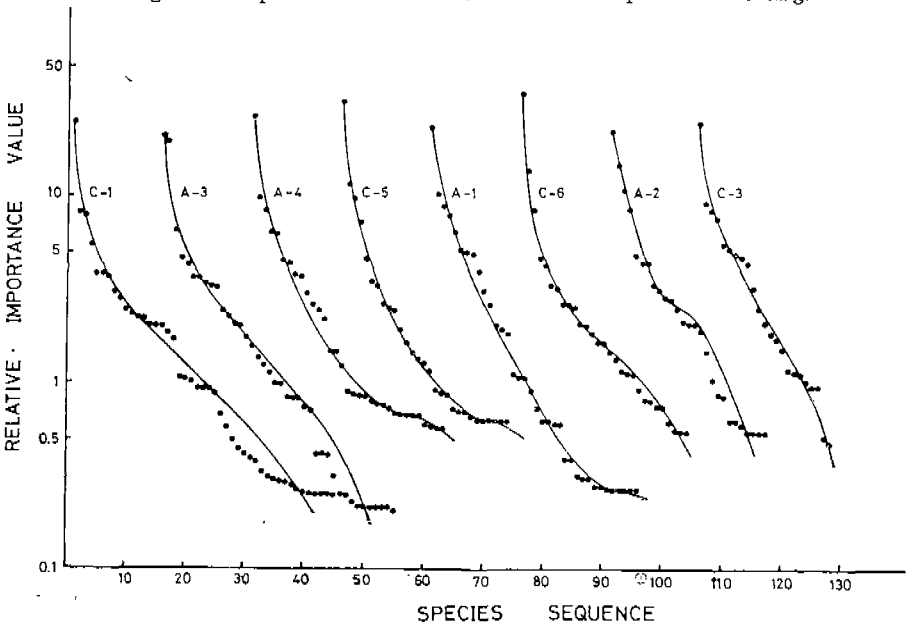

Fig. 4-b. Importance value curves for various slopes in Mt. Seolag.

The dominance concentrations among the southern, northern and western slope of Daecheongbong are compared with Shannon's index H'. i,e. H'=1.442 at northern slope, H'=1.282 at southern slope and H'=1.385 at western slope. From results of the H' values and species richness, we can explain environmental condition of each slope; northern slope is milder than southern one, and western is medium condition between both slopes mentioned above (Fig 4-a, b). The H' values are also smaller at mountain foot area than top or breast area of same slope. Considering the fact that the disturbance of mountain foot vegetation by human activity is clear even in appearanee, we can insist on the usefulness of H' value as a measure of disturbance degree from natural vegetation.

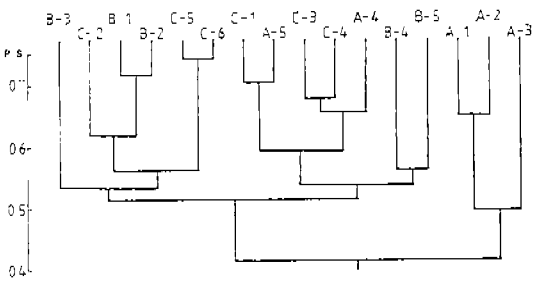

Fig. 5. Dendrogram framed by the cluster analysis of Mountford (1962).

Site A-1, A-2 and A-3 differ from other all sites sampled, because they are located at relatively low area and at area with various naturality. Exception these sites, all other sites are grouped in two groups by mean of similarity of community calculated percentage-similarity, over Ps=0.5 level.

However, for the generalization of the conclusion obtained in this study, the further more test would be need because the used data are limited in only tree species in DBH≧2cm.

摘 要

1981年 5月부터 1983年 8月까지 사이에 雪嶽山의 斜面과 溪谷을 포함한 16個 調査地에 대한 野外調査資料를 基礎로 하여 同地域의 森林植生의 優占度—多樣性을 檢討하였다.

여기에서 作成된 優占度—多樣性 曲線을, 이제까지 提示된 Random Niche hypothesis, Niche Preemption hypothesis, Lognormal distribution 그리고 Logarithmic series에 立脚하여 檢討한 結果, 大體로 lognormal distribution의 形을 나타내고 있으나, 人間의 干涉이 酷甚한 곳이나 岩石地帶와 같이 物理的 環境이 좋지 못한 곳에서는 geometric series에 近似함을 알 수 있었다.

大靑峰의 南斜面, 北斜面과 西斜面을 Shannon's index, H'로 比較하여 보면 南斜面은 H'=1,282, 北斜面은 H'=1,442, 西斜面은 H'=1,385로서 北斜面이 南斜面보다 좋은 條件이며 西斜面은 그들의 中間임을 立證하였다. 또한 破壞가 甚한 山麓의 植生은 山中腹 以上의, 比較的 植生이 잘 保全된 곳보다 H'값이 낮게 나타났다.

또 雪嶽山 全體에 對하여 볼 때, 記錄 調査한 樹種 113種의 種序列에서 上位인 10種은 *Quercus mongolica, Pinus densiflora, Acer pseudosieboldianum, Quercus serrata, Carpinus laxiflora, Styrax obassia, Fraxinus rhychophylla, Tilia amurensis, Lindera obtusiloba, Abies holophylla* 順으로 나타났다.

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