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Actual Vegetation and Potential Natural Vegetation of Seonunsan Area, Southwestern Korea

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禪雲山 地域의 現存植生과 潛在自然植生

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ABSTRACT

The potential natural vegetation of Seonunsan area, southwestern Korea, was inferred from the actual vegetation. In previous two papers the plant communities of actual vegetation of the area is grouped into nine types; *Quercus variabilis*, *Pinus densiflora*, *Carpinus tschonoskii*, *Quercus serrata*, *Camellia japonica* (plantation), *Quercus aliena*, *Pinus thunbergii*, *Zelkova serrata* and *Carpinus laxiflora* forest.

With the analysis of species richness, age structure and various informations on vegetation changes of the plant communities, two paths of late stage succession are suggested in climatic climax starting from *Pinus densiflora* forest in the area. One is through *Quercus variabilis* forest to *Carpinus laxiflora* forest in upper parts of the mountain and the other through *Quercus aliena* forest to *Carpinus tschonoskii* forest in lower parts of the mountain.

With analysis of actual vegetation and the examination of informations including human activities in the area, the potential natural vegetation of the area was inferred. The potential natural vegetation of the area was mainly composed of *Carpinus laxiflora*, *Carpinus tschonoskii*, *Pinus densiflora* and *Zelkova serrata* forest.

The actual vegetation map and potential natural vegetation map (scale, 1:25,000) and other results from this study might be the useful data for the protection of natural vegetation and restoration of the current vegetation.

INTRODUCTION

Six lucidophyll species among 477 vascular plants listed in previous two papers (Kim and Yim, 1986a, b) were known as northern distributional limit of the species in the area (Lee, 1979); *Camellia japonica* (planted), *Eunymus fortunei* var. *radicans*, *Orixa japonica*, *Hedera rhombea*, *Trachelospermum asiaticum* var. *intermedium*, *Zanthoxylum planispisum* and *Torreya nucifera*. These species are distributed in lower slopes, especially southern

ravines, while most tree species in the mountain are broad leaved deciduous species.

However, present range of species and community distribution do not indicate their potential natural ranges, considering of large parts of the disturbed by human impact. To discern the potential natural vegetation and species distribution range, these analyses were taken on the age structure of plant communities, the behavior of different species and species richness within plant community in relation to abiotic environmental factors.

METERIALS AND METHODS

Species richness and age structure analyses

The species richness and dbh class-frequency within plant community were analyzed for the sample data of the previous two studies (Kim and Yim, 1986a,b). The species richnes (r) or diversity for the eight communities by Z-M method (Kim and Yim, 1986a) was calculated by the follow equation (Whittaker, 1975):

$$r = S/\log A$$

where, S=number of species in given sample

A=sample area

The trees over 3 cm in dbh, seedlings (dbh$<$0.5 cm) and saplings (0.5 cm$\leqslant$dbh$<$3 cm) occurred in plant community were censused for age structure analysis and the modes of dbh class-frequency in different community were examined for the determination of successional stage (Kim, 1977; Despain, 1983).

Vegetation mapping

The actual vegetation map of the area in scale 1:25,000 was made based on the results of phytosociological classification and ordinations by Kim and Yim (1986a,b) (Brush *et al.*, 1980; Babalonas, 1980; Abbott, 1981; Schroeder, 1983). And, with the basis of the actual vegetation map, the potential natural vegetation map with scale of 1:25,000 was made, considering the factors limiting vegetation distribution including physical conditions (Küchler, 1967; Stumpel and Kalkhoven, 1978; Suzuki *et al.*, 1979; Toyohara *et al.*, 1983), informations from soil map (Office of Rural Development, 1975), plantation records and fire records etc. (Chunbuk Ilbosa, 1987; Chollabukdo, 1984).

RESULTS AND DISCUSSION

Distribution of actual vegetation

The actual vagetation map (Fig. 1) showed four types of distributional types *Quercus variabilis* and *Pinus densiflora* community on large area, *Carpinus laxiflora*, *Carpinus tschonoskii*, *Quercus serrata* and *Camellia japonica* community in restricted area around the Seonun temple, *Zelkova serrata* commnnity within ravines and *Quercus aliena* community in mesic lower slopes and flat land.

Quercus variabilis, *Pinus densiflora* and *Pinus thunbergii* forest are the secondary forests due to human activities. Most trees of the forests had been repeatedly cut. The undergrowth

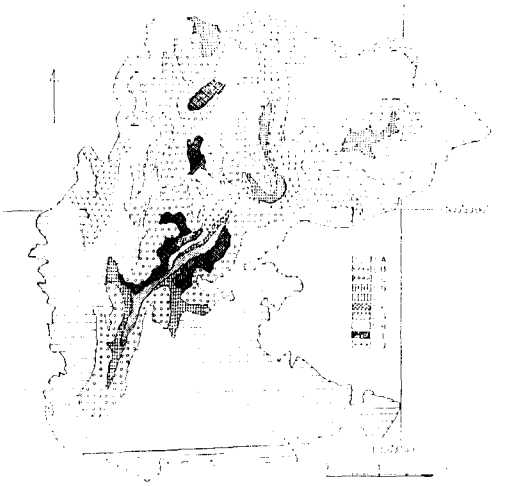

Fig. 1. Actual vegetion map of Seonunsan area. A; Rhododendro mucronulati-Pinetum densiflorae, B; *Pinus thunbergii* community, C; Quercetum variabilis, D; *Quercus aliena* community, E; *Quercus serrata* community, F; Carpinetum laxiflorae, G; Carpinetum tschonoskii, H; Orixo-Zelkovetum serratae, I; *Thea sinensis-Camellia japonica* community, J; Crop land.

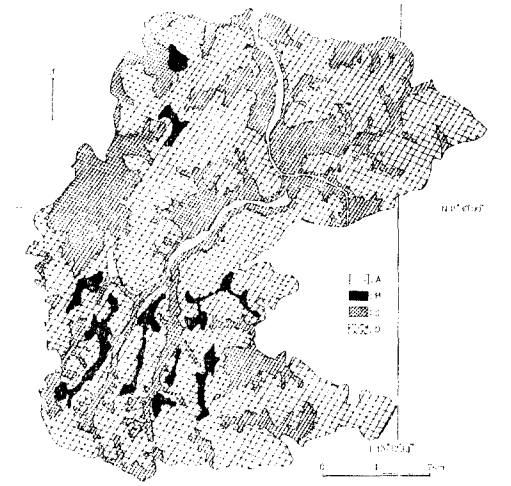

Fig. 2. Potential natural vegetation map of Seonunsan area. A; Orixo-Zelkovetum serratae, B; Rhododendro mucronulati-Pinetum densiflorae, C; Carpinetum tschonoskii, D; Carpinetum laxiflorae.

of the forest grazed for domestic animals and subjected to be as edible plants and burning for field crop. After designation of the area as the provincial park in 1979, however, the forests had been preserved under the laws of natural conservation.

Carpinus tschonoskii, *Carpinus laxflora* and *Zelkova serrata* forest (natural forests) are found in restricted area. *Camellia japonica* forest around Seonun temple, which is planted 200 years ago, reflect some mild climate of the area.

The distribution pattern of the actual vegetation was fairly similar with some characters of soil types by Office of Rural Development (1975), for example, on mesic loam soils (sandy and gravely loam soil) *Carpinus tschonoskii*, *Zelkova serrata* and *Quercus aliena* community, on stony loam soils *Carpinus laxiflora*, *Quercus serrata* and *Quercus variabilis* community, and on xeric rock land *Pinus densiflora*.

Changes in actual vegetation

Quercus variabilis forests at above 120 m in altitude (Table 1) are composed of *Quercus variabilis* in small numbers of large size trees in dbh and *Carpinus laxiflora* in large numbers of small size trees. In the forest the numbers of seedlings and saplings of *Carpinus laxiflora* are 24 times more than those of *Quercus variabilis*. It means that *Quercus variabilis* forest can be replaced by *Carpinus laxiflora* forest in successional series.

Quercus aliena forests at below 120 m in altitude (Table 2) are composed of *Quercus aliena* in small numbers of large size trees in dbh and *Carpinus tschonoskii* in large numbers

Table 1. DBH class-frequency of species in *Quercus variabilis* forest in Seonunsan area

Species	dbh class(cm)												
	seeling	sapling	~6	~9	~12	~15	~18	~21	~24	~27	~30	~33	~36
Quercus variabilis	100	11	—	—	2	—	—	—	—	2	1	—	1
Quercus aliena	400	82	3	1	4	1	—	—	1	—	—	—	—
Carpinus laxiflora	2,200	211	9	4	4	2	1	—	1	—	—	—	—
Acer pseudo-sieboldianum var. *koreanum*	1,300	78	1	—	—	—	—	—	—	—	—	—	—

Note: Numerals are number of stems. Atitude 150 m, quadrat size (10×10)m

Table 2. DBH class-frequency of species in *Quercus aliena* forest in Seonunsan area

Species	dbh class(cm)											
	seedling	sapling	~6	~9	~12	~15	~18	~21	~24	~27	~30	~33
Quercus variabilis	—	—	—	—	—	—	—	—	—	—	—	1
Quercus aliena	—	11	3	1	—	1	1	—	—	1	3	2
Carpinus tschonoskii	1,100	278	4	2	3	1	—	—	—	—	—	—
Acer pseudo-sieboldianum var. *koreanum*	600	233	5	—	—	1	—	1	—	—	—	—

Note: Altitude 60 m, quadrat size (15×15)m

of small size trees. The stems of seedling and sapling of *Carpinus tschonoskii* are 140 times more than those of *Quercus aliena.* It also suggests the successional change from *Quercus aliena* forest to *Carpinus tschonoskii* forest.

The zonal distribution of forest vegetation in relation to thermal climate expressed as warmth index, WI, showed two zones of *Carpinus tschonoskii* and *Carpinus laxiflora* zone in formation level (Yim, 1977), WI 100°C·month or more range or lower elevations from 120m and WI 90-100°C·month or less range or upper elevations from 120 m in altitude.

Species richness index in different communities showed largely small values in secondary forests such as *Pinus densiflora* and *Quercus aliena* forest while large values in natural forests such as *Carpinus laxiflora, Zelkova serrata* and *Carpinus tschonoskii* forest (Table 3). It indicates species richness decreasing tendency in successional series as pointed by many investigators (Shafi and Yarranton, 1973; Song, 1985).

Potential natural vegetation

The results of classification and ordination, the analyses of species richness, and dbh class-frequency suggest two paths of late stage succession in this area. These are from *Pinus densiflora* forest to *Carpinus laxiflora* forest through *Quercus variabilis* forest in upper parts and to *Carpinus tschonoskii* forest through *Quercus aliena* forest in lower parts of the mountain:

Pinus densiflora forest → *Quercus variabilis* forest → *Carpinus laxiflora* forest
Pinus densiflora forest → *Quercus aliena* forest → *Carpinus tschonoskii* forest

Pinus densiflora forest on hillok or exposed ridge and *Zelkova serrata* forest on well

Table 3. Species richness index (r) in different communities in Seonunsan area

Community	r	Community	r
Pinus densiflora	15.65	*Quercus serrata*	11.66
Quercus aliena	16.94	*Zelkova serrata*	15.30
Camellia japonica	16.00	*Carpinus tshonoskii*	15.60
Quercus variabilis	13.62	*Carpinus laxiflora*	12.25

drained stony slopes or streamsides may considered as a topographic or edaphic climax forest in this mountain. Therefore, the potential natural vegetation of the mountain were mainly composed of *Carpinus laxiflora*, *Carpinus tschonoskii*, *Pinus densiflora* and *Zelkova serrata* forest (Fig. 2).

The differences between actual vegetation and potential natural vegetation map reflect that the large part of the area destroyed by human activities except resticted area around the Seonun temple. Therefore, the actual vegetation and potential natural vegetation map and/or many informations obtained by this study will be contributed to the protection of natural vegetations and plantation for nature conservation.

摘 要

禪雲山 地域 植生의 分類와 環境傾度分析, 植物群集內의 種豊富性 및 年齡組成分析을 通하여 森林植生의 氣候極相과 土壤的 極相을 밝혀 潛在自然植生의 分布를 推察하였다.

이 地域에는 現在 굴참나무, 소나무, 서어나무, 개서어나무, 졸참나무, 동백나무(植栽), 갈참나무, 곰솔과 느티나무林이 分布하고 있다. 이들 植物群集의 種豊富性, 年齡組成, 그리고 人爲的 影響 등을 分析하여 이들 群集의 氣候極相에 이르는 後期遷移過程에는 陽樹林인 소나무林으로부터 시작하여 高地帶의 굴참나무林을 거쳐 서어나무의 極相林에 이르는 過程과 低地帶의 갈참나무林을 거쳐 개서어나무 極相林에 이르는 두 系列이 있음이 밝혀졌다.

이리하여 同地域의 潛在自然植生은 氣候와 地形 또는 土壤的 條件에 따라 서어나무林, 개서어나무林, 소나무林과 느티나무 極相林이 分布할 것으로 보인다.

이 硏究에서 얻은 現存植生圖와 潛在自然植生圖, 그밖의 知見은 이 地域의 自然植生의 保護, 破壞된 植生의 復元을 위한 造林樹種의 選定, 生態境界(ecotone)의 保護, 造景 등에 이용될 수 있을 것이다.

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