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Vegetation Composition and Structure of *Sorbus commixta* - Native Forests in South Korea

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남한지역 마가목 자생임지의 식생조성과 구조

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ABSTRACT

Vegetation composition and structure of *Sorbus commixta* - native forests of South Korea were studied using phytosociological procedures and its ecological characteristics analyzed with special respect to species correlations, importance values, and constancy classes. Vegetation types were divided (great division) into *Tripterygium regelii* - *Quercus mongolica* (Inland high mountain type) and *Acer takesimense* - *Fagus crenata* var. *multinervis* (Ulleung Island type) and ten accompanying vegetation units. In between *S. commixta* and life-forms, 120 correlations were positive with 23 of these having a p-value < 0.01 for trees, 21 for shrubs, 10 for woody vines, and 25 for herbs. In trees, there was a positive correlation between *S. commixta* and *A. takesimense* and *T. insularis* on the 1% level. In shrubs, there was a positive correlation between *S. commixta* and *Sasa kurilensis, Callicarpa japonica, Ligustrum foliosum* on the 5% level. In woody vines, there was a negative correlation between *S. commixta* and *Tripterygium regelii* and *Actinidia rufa* on the 1% level. In herbs, there was a positive correlation between *S. commixta* and *Majanthemum dilatatum* and *Solidago virga-aurea* var. *gigantea* on the 1% level.

Key words : **Vegetation composition and structure, Phytosociological procedures, Vegetation types, Vegetation units**

I. INTRODUCTION

A plant community is an organized complex with typical floristic composition and morphological structure which have resulted from the interaction of species populations through time (Shimwell, 1971). The distribution of a species population depends upon several factors directly related to phenotypic plasticity, genotypic adaptability, and competitive, reproductive, and tolerance capacities of the species. The ecological amplitude of the species is thus quite important to its existence in a particular habitat. Generally, an ecological technique for conserving and managing the forest vegetation in a given area is based on vegetation units classified by composition and structure of the plant society. Classifying vegetation units is helpful for better understanding how to manage different plant communities and for facilitating further systematic and coordinated conservation and management of forest vegetation (USDA Forest Service, 1989). *S. commixta* is the deciduous broad-leaf subtree which grows in deep mountaians at an

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elevation of 500 m to 1,200 m. It also grows in isolated locations such as Ulleung Island and Jeju Island. *S. commixta* is not abundant in our country, although it grows over a wide range along the high mountain backbone of S. Korea. But *S. commixta* have been indiscreetly collected due to medicinal and other uses and its abundance has been greatly reduced. In spite of this situation with *S. commixta*; there has not yet been any attempt to conserve and manage *S. commixta* - native forests in our country. Therefore, this study is to clarify the vegetation composition and structure of *S. commixta* - native forests with special regard to its conservation and management.

II. STUDY AREAS AND METHODS

During the summers of 2000 to 2003, fifteen *S. commixta* - naitved forest sites were sampled in South Korea (Fig. 1). *S. commixta* - native forests (SCNF) are found mostly near the ridge tops. *S. commixta, Taxus cuspidata, Rhododendron brachycarpum,* and *Dryopteris crassirhizoma* were the consistent species. A survey was conducted in two hundred one plots within the SCNF sites. Plots of 10 m × 10 m were used to analyze the floristic composition and structure of these sites. All strata were estimated according to the Braun-Blanquet cover-abundance scale (r, +, 1, 2, 3, 4, 5). Details of the approach can be found in Mueller-

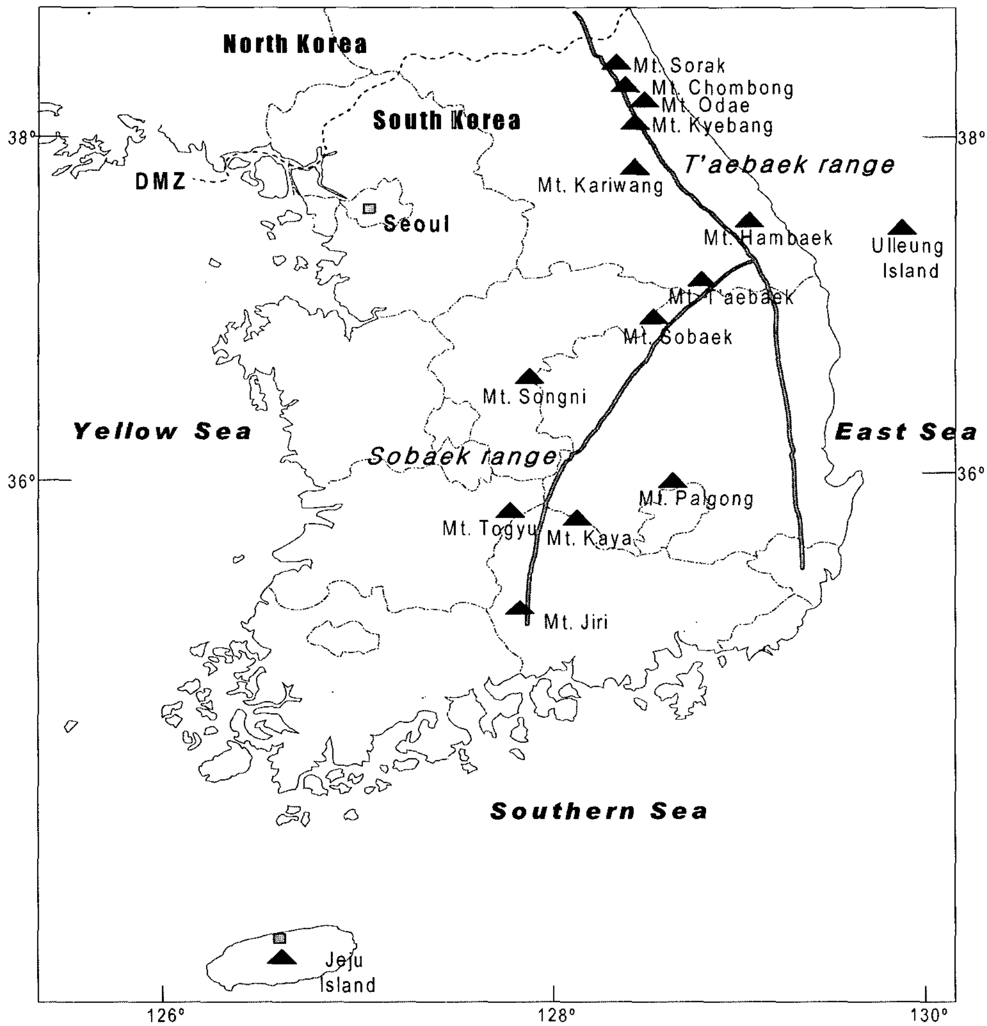

Fig. 1. Location of the study sites (▲).

Dombois & Ellenberg (1974).

The delineation of forest plant communities is based on floristic-structural relevés which were established using the floristic-physiognomic approach introduced by Braun-Blanquet (Braun-Blanquet, 1964; Mueller-Dombois and Ellenebrg, 1974). The syntaxonomically pre-defined term 'association' (Braun-Blaquet, 1964) was not used because character species in their strict sense (Knapp, 1971) could not be defined. The central vegetation unit was termed 'community'. No synsystematical ranking of the vegetation units was attempted and their hierarchical positions are not yet clear. Communities were arranged in 'community groups or types' if clear floristic and structural similarities existed. The term 'group' was used for floristically recognizable differences within the community which cannot be ascribed to obvious ecological divergencies. The term 'subgroup' has been adopted to describe floristic differences within a subgroup. From these data various ecological characteristics such as importance value of each species, constancy classes, interspecific correlation, species diversity, and community similarity was analyzed (Peet, 1974; Clarke, 1994; Mueller-Dombois and Ellenberg 1974). Nomenclature follows Lee (1985).

III. RESULTS AND DISCUSSION

3.1. Vegetation classification

The forest communities, where *S. commixta* is distributed naturally, were classified using the phytosociological procedures of S. Korea. It is greatly divided into an inland high mountain type and Ulleung Island type. A description of these vegetation types and their subordinate units is as follows.

I. *Tripterygium regelii* - *Quercus mongolica* community group(Inland high mountain type; VT I)

This vegetation type develops chiefly at a high mountain zone with thin soil in somewhat humid conditions of an inland and Mt. Halla. This is recognized as having *T. regelii, Rhododendron schlippenbachii, Vaccinium koreanum, Q. mongolica,* etc. of the species group 2. This is further subdivided into two communities, four groups, and four subgroups with a total of six vegetation units by a combination of the species groups 3 to 11 and *Dryopteris crassirhizoma, Taxus cuspidata* of the species group 12. *C. lanceolata* - *A. koreana* community is found mainly in southern temperate zones such as Mt. Halla, Mt. Jiri, Mt. Dogyu, and Mt. Kaya. This is subdivided into two lower units of the *B. ermanii* var. *saitoana* - *T. cuspidata* group and *R. mucronulatum* group. *R. mucronulatum* group is further subdivided into two lowest units of *P. densiflora* subgroup and *Deutzia parviflora* - *P. koraiensis* subgroup by a combination of the species groups 6 to 7. The *C. siderosticta* - *A. nephrolepis* community is found mainly in the central temperate zone and developed mostly in and around the Taebaek range, which comprises the frame of Baekdudaegan. This is subdivided into two lower units of *Syringa wolfii* - *Thuja koraiensis* group and *Meehania uriticifolia* - *Acer mono* group by a combination of the species groups 9 to 10. *M. uriticifolia* - *A. mono* groupis further subdivided into two lowest units of *Dryopteris crassirhizoma* - *T. cuspidata* subgroup and *Tilia amurensis* subgroup by a combination of species groups 11 to 13. The *D. crassirhizoma* - *T. cuspidata* subgroup is developed mostly on rocky sites in Mt. Jumbong, Mt. Ode, Mt. Taebaek, and Mt. Hambaek. The *T. amurensis* subgroup developed on the upper slope of Mt. Sohwangbeong, Jingogae, Hwangcheolbong, Kumdaebong, Durubong, and Yaksubong.

II. *Acer takesimense* - *Fagus crenata* var. *multinervis* community group ((Ulleung Island type; VT II)

This vegetation type is found mainly at the Ulleung Island. This is distinguished from the inland high mountain type by the presence of species groups 13 as the character species. This is further subdivided into two communities, four groups, and a total of four vegetation units by combinations of the species in groups 14 to 18. The *Dystaenia takeshimana* - *Acer okamotoanum* community is distinguished from the *R. brachycarpum* - *T. sieboldii* community by having the differential species group 14, but lacking the 17. It is a secondary community developed on the vertical middle part of the mountains at elevations of 500 m to 800 m. This is further subdivided into two types of *Hepatica maxima* group and *Aster glehni* - *Pinus thunbergii* group by differential species groups 15 and 16. *H. maxima* group, with the differential species group 15, develops in places slightly influenced by man. The *A. glehni* - *P. thunbergii* group, with differential species group 16, develops on the lower slopes where man's influence is strong. The *R. brachycarpum* - *Tsuga sieboldii* community is recognized by having *T. sieboldii* and *P. parviflora* of

Table 1. Vegetation types and its units of S. commixta-native forests: synoptic table

I. *Tripterygium regelii* - *Quercus mongolica* (Inland high mountain type)
I-A. *Carex lanceolata* - *Abies koreana* community
I-A-1. *Betula ermanii* var. *saitoana* - *Taxus cuspidata* grou
I-A-2. *Rhododendron mucronulatum* group
I-A-2-a. *Pinus densiflora* subgroup
I-A-2-b. *Deutzia parviflora* - *Pinus koraiensis* subgroup
I-B. *Carex siderosticta* - *Abies nephrolepis* community
I-B-1. *Syringa wolfii* - *Thuja koraiensis* group
I-B-2. *Meehania uriticifolia* - *Acer mono* group
I-B-2-a. *Dryopteris crassirhizoma* - *T. cuspidata* subgrou
I-B-2-b. *Tilia amurensis* subgroup

II. *Acer takesimense* - *Fagus crenata* var. *multinervis* (Ulreung Island type)
II-A. *Dystaenia takeshimana* - *Acer okamotoanum* community
II-A-1. *Hepatica maxima* group
II-A-2. *Aster glehni* - *Pinus thunbergii* group
II-B. *Rhododendron brachycarpum* - *Tsuga sieboldii* community
II-B-1. *Polypodium vulgare* - *Camellia japonica* group
II-B-2. Typical group

Vegetation types hierarchy	I						II				Constancy classes
	A			B			A		B		
	1	2		1	2		1	2	1	2	
		a	b		a	b					
Vegetation units no.*	1	2	3	4	5	6	7	8	9	10	
Total number of species	40	35	132	156	138	212	131	96	60	30	
Mean total no. of species (/100 m²)	24$_{8}$**	20$_{5}$	23$_{6}$	25$_{6}$	27$_{8}$	39$_{13}$	18$_{5}$	18$_{5}$	17$_{5}$	12$_{5}$	
Mean total cover (/100 m²)	213$_{17}$	197$_{16}$	164$_{37}$	188$_{50}$	115$_{50}$	171$_{45}$	193$_{54}$	189$_{40}$	171$_{50}$	176$_{25}$	
Number of releves	4	3	36	28	12	20	56	23	13	6	
[1] *Sorbus commixta*	4$_{8}$	3$_{5}$	V$_{3}$	V$_{7}$	V$_{5}$	V$_{3}$	V$_{22}$	V$_{22}$	V$_{16}$	V$_{23}$	V
[2] *Tripterygium regelii*	-	2$_{0}$	V$_{10}$	IV$_{7}$	V$_{11}$	V$_{4}$	-	-	-	-	III
Rhododendron schlippenbachii	-	3$_{24}$	V$_{11}$	IV$_{9}$	II$_{0}$	IV$_{14}$	-	-	-	-	II
Acer pseudo-sieboldianum	-	3$_{0}$	III$_{1}$	IV$_{4}$	III$_{7}$	V$_{8}$	-	-	-	-	II
Betula ermani	-	-	IV$_{6}$	IV$_{22}$	IV$_{8}$	II$_{11}$	-	-	-	-	II
Quercus mongolica	-	3$_{38}$	II$_{1}$	IV$_{10}$	III$_{3}$	V$_{18}$	-	-	-	-	II
Acer tschonoskii var. rubripes	-	-	III$_{4}$	IV$_{6}$	IV$_{7}$	III$_{6}$	-	-	-	-	II
Pinus koraiensis	-	-	V$_{6}$	IV$_{4}$	I$_{0}$	I$_{0}$	-	-	-	-	II
Solidago virga-aurea var. asiatica	-	-	IV$_{4}$	IV$_{2}$	II$_{0}$	I$_{0}$	-	-	-	-	II
Ligularia fischeri	2$_{9}$	-	IV$_{3}$	II$_{1}$	II$_{0}$	II$_{1}$	R$_{0}$	-	-	-	II
Calamagrostis arundinacea	-	3$_{14}$	V$_{16}$	II$_{2}$	III$_{1}$	R$_{0}$	-	-	-	-	II
Astilbe chinensis var. davidii	-	2$_{0}$	III$_{0}$	II$_{1}$	II$_{0}$	III$_{1}$	I$_{0}$	R$_{0}$	-	-	II
Euonymus macroptera	-	-	III$_{0}$	I$_{1}$	IV$_{1}$	III$_{0}$	-	-	-	-	I
Vaccinium koreanum	2$_{0}$	3$_{3}$	II$_{0}$	III$_{1}$	I$_{1}$	R$_{0}$	-	-	-	-	I
[3] *Abies koreana*	4$_{88}$	-	V$_{65}$	-	II$_{0}$	-	-	-	-	-	II
Carex lanceolata	2$_{19}$	1$_{6}$	IV$_{3}$	-	I$_{0}$	-	-	-	-	-	I
Euonymus pauciflorus	2$_{0}$	-	II$_{0}$	-	I$_{0}$	R$_{1}$	-	-	-	-	I
[4] *Sorbus alnifolia*	4$_{8}$	-	I$_{0}$	-	-	II$_{0}$	-	-	-	-	I
Lycopodium chinensis	4$_{0}$	-	I$_{0}$	I$_{1}$	-	-	-	-	-	-	I
Schizophragma hydrangeoides	2$_{0}$	-	-	-	-	-	I$_{0}$	I$_{2}$	-	-	I
Berberis amurensis	2$_{4}$	-	-	I$_{0}$	I$_{1}$	I$_{1}$	-	-	-	-	I
Bupleurum longiradiatum	2$_{0}$	-	I$_{0}$	I$_{0}$	-	II$_{0}$	-	-	-	-	I
Betula ermanii var. saitoana	4$_{8}$	-	R$_{0}$	-	-	-	-	-	-	-	R
[5] *Rhododendron mucronulatum*	-	3$_{31}$	IV$_{4}$	I$_{1}$	I$_{0}$	I$_{0}$	-	-	-	-	I
[6] *Pinus densiflora*	-	3$_{42}$	I$_{1}$	-	I$_{7}$	I$_{0}$	-	-	-	-	R
Patrinia saniculaefolia	-	2$_{12}$	-	I$_{2}$	-	R$_{1}$	-	-	-	-	R
Melampyrum roseum	-	2$_{0}$	-	-	-	-	-	-	-	-	R
[7] *Deutzia parviflora*	-	-	III$_{1}$	R$_{0}$	-	R$_{0}$	-	-	-	-	I
Fraxinus sieboldiana	-	1$_{3}$	III$_{1}$	-	-	-	-	-	-	-	I
Dryopteris bissetiana	-	-	III$_{1}$	I$_{1}$	-	-	-	-	-	-	I
Picea jezoensis	-	-	II$_{4}$	-	-	-	-	-	-	-	I
[8] *Carex siderosticta*	-	-	I$_{0}$	III$_{9}$	II$_{1}$	IV$_{5}$	-	-	-	-	I
Abies nephrolepis	-	-	-	V$_{21}$	II$_{1}$	II$_{3}$	-	-	-	-	I
Aconitum jaluense	-	-	R$_{0}$	III$_{2}$	III$_{0}$	III$_{0}$	-	-	-	-	I
Magnolia sieboldii	-	2$_{0}$	R$_{0}$	II$_{0}$	IV$_{4}$	III$_{1}$	-	-	-	-	I
Pimpinella brachycarpa	-	-	R$_{0}$	II$_{2}$	III$_{1}$	III$_{1}$	-	-	-	-	I
Pedicularis resupinata	-	-	R$_{0}$	III$_{2}$	I$_{0}$	III$_{1}$	-	-	-	-	I
[9] *Syringa wolfii*	-	-	-	V$_{3}$	I$_{0}$	R$_{0}$	-	-	-	-	I
Lonicera sachalinensis	-	-	-	IV$_{7}$	-	R$_{0}$	-	-	-	-	I
Thuja koraiensis	-	-	-	III$_{7}$	I$_{3}$	-	-	-	-	-	I
Rhododendron mucronulatum var. ciliatum	2$_{0}$	-	-	III$_{8}$	-	-	-	-	-	-	I
Weigela florida	-	-	-	II$_{1}$	-	I$_{3}$	-	-	-	-	R
Rosa davurica	-	-	-	II$_{1}$	-	-	-	-	-	-	R
[10] *Meehania uriticifolia*	-	-	-	I$_{0}$	IV$_{1}$	III$_{5}$	-	-	-	-	I
Pseudostellaria palibiniana	-	-	-	I$_{0}$	II$_{0}$	III$_{3}$	-	-	-	-	I
Acer mono	-	-	-	I$_{0}$	II$_{1}$	IV$_{2}$	-	-	-	-	I
Prunus padus	-	-	-	I$_{3}$	III$_{1}$	II$_{2}$	-	-	-	-	I
Aconitum pseudo-laeva var. erectum	-	-	I$_{0}$	R$_{0}$	II$_{1}$	II$_{0}$	-	-	-	-	I

Table 1. Continued

Vegetation units no.	1	2	3	4	5	6	7	8	9	10	
11 *Saussurea grandifolia*	-	-	II$_{1}$	I$_{0}$	III$_{1}$	I$_{0}$	I$_{0}$	-	I$_{0}$	-	I
Clematis koreana	-	-	I$_{0}$	I$_{0}$	III$_{0}$	-	-	-	-	-	I
Polystichum tripteron	-	-	R$_{0}$	-	III$_{0}$	-	I$_{0}$	-	-	-	R
12 *Isodon inflexus*	-	-	-	I$_{0}$	I$_{0}$	III$_{3}$	I$_{0}$	II$_{0}$	-	-	I
Ainsliaea acerifolia	-	-	II$_{3}$	II$_{3}$	-	III$_{2}$	-	-	-	-	I
Artemisia stolonifera	-	-	-	II$_{0}$	-	III$_{0}$	-	-	-	-	I
Asarum sieboldii	2$_{0}$	-	I$_{0}$	-	I$_{0}$	III$_{0}$	-	-	-	-	I
Tilia amurensis	-	-	-	I$_{0}$	-	IV$_{6}$	-	-	-	-	I
Fraxinus rhynchophylla	-	-	I$_{0}$	R$_{1}$	I$_{0}$	III$_{4}$	-	-	-	-	I
Cornus controversa	-	-	I$_{2}$	-	I$_{0}$	II$_{2}$	I$_{1}$	-	-	-	I
Lychnis cognata	-	-	R$_{0}$	-	I$_{0}$	III$_{0}$	-	-	-	-	I
Betula costata	-	-	-	I$_{3}$	-	II$_{2}$	-	-	-	-	R
Spiraea frirschiana	-	-	-	I$_{0}$	I$_{0}$	II$_{5}$	-	-	-	-	R
13 *Dryopteris crassirhizoma*	2$_{0}$	-	I$_{0}$	R$_{0}$	V$_{10}$	II$_{0}$	IV$_{6}$	III$_{1}$	V$_{3}$	II$_{0}$	III
Taxus cuspidata	4$_{8}$	-	I$_{0}$	II$_{1}$	IV$_{25}$	-	II$_{3}$	II$_{2}$	IV$_{4}$	V$_{10}$	II
Acer takesimense	-	-	-	-	-	-	IV$_{8}$	IV$_{7}$	III$_{3}$	V$_{13}$	II
Allium victorialis var. *platyphyllum*	-	-	-	-	-	-	V$_{22}$	II$_{5}$	II$_{7}$	II$_{1}$	II
Solidago virga-aurea var. *gigantea*	-	-	-	-	-	-	III$_{0}$	IV$_{4}$	IV$_{2}$	IV$_{4}$	II
Fagus crenata var. *multinervis*	-	-	-	-	-	-	III$_{17}$	I$_{1}$	IV$_{7}$	III$_{24}$	II
Tilia insularis	-	-	-	-	-	-	III$_{12}$	II$_{5}$	IV$_{12}$	III$_{5}$	II
Majanthemum dilatatum	-	-	-	-	I$_{1}$	R$_{0}$	I$_{3}$	II$_{17}$	III$_{1}$	V$_{8}$	I
14 *Dystaenia takeshimana*	-	-	-	-	-	R$_{0}$	V$_{11}$	V$_{9}$	II$_{1}$	I$_{0}$	II
Acer okamotoanum	-	-	-	-	-	R$_{0}$	V$_{28}$	III$_{7}$	II$_{5}$	-	II
Hydrangea petiolaris	-	-	-	-	-	-	IV$_{4}$	III$_{3}$	II$_{0}$	II$_{0}$	II
Ligustrum obtusifolium	-	-	-	-	-	-	II$_{2}$	IV$_{7}$	I$_{0}$	I$_{0}$	I
Disporum sessile	-	-	-	-	-	-	III$_{2}$	III$_{1}$	I$_{0}$	-	I
Asperula odorata	-	-	-	-	-	-	III$_{0}$	II$_{0}$	I$_{0}$	-	I
Styrax obassia	-	-	-	-	-	-	II$_{2}$	IV$_{8}$	I$_{2}$	I$_{1}$	I
Prunus takesimensis	-	-	-	-	-	-	II$_{6}$	II$_{2}$	I$_{1}$	-	I
15 *Hepatica maxima*	-	-	-	-	-	-	III$_{1}$	R$_{0}$	III$_{0}$	-	I
Viola kusanoana	-	-	-	-	-	R$_{0}$	III$_{1}$	I$_{0}$	-	-	I
Smilax nipponica	-	-	-	-	-	R$_{0}$	III$_{0}$	I$_{0}$	I$_{0}$	I$_{0}$	I
Lilium hansonii	-	-	-	-	-	-	III$_{1}$	I$_{0}$	I$_{0}$	-	I
Rumohra atandishii	-	-	-	-	-	-	II$_{7}$	R$_{0}$	I$_{0}$	-	I
16 *Aster glehni*	-	-	-	-	-	-	I$_{0}$	III$_{1}$	-	I$_{0}$	I
Pinus thunbergii	-	-	-	-	-	-	R$_{1}$	III$_{24}$	-	-	I
17 *Rhododendron brachycarpum*	-	-	-	II$_{1}$	I$_{1}$	-	I$_{0}$	R$_{0}$	III$_{1}$	V$_{55}$	I
Tsuga sieboldii	-	-	-	-	-	-	I$_{1}$	-	V$_{27}$	IV$_{16}$	I
Pinus parviflora	-	-	-	-	-	-	R$_{0}$	I$_{1}$	V$_{44}$	III$_{13}$	I
18 *Hedera rhombea*	-	-	-	-	-	-	II$_{1}$	III$_{2}$	III$_{1}$	-	I
Camellia japonica	-	-	-	-	-	-	I$_{5}$	III$_{9}$	IV$_{10}$	-	I
Alnus maximowiczii	-	-	-	-	-	R$_{4}$	I$_{4}$	II$_{12}$	II$_{3}$	I$_{1}$	I
Polypodium vulgare	-	-	-	-	-	-	R$_{0}$	I$_{0}$	IV$_{1}$	I$_{0}$	I

Note : Roman numerals: presence value of a species within a group (i.e. proportion of releves within which that species occurs: R=5% or under, I =5.1-20%, II =20.1-40%, III=40.1-60%, IV=60.1-80%, V =80.1% or over). Numbers: mean cover values of a species within a vegetation unit. *= vegetation unit no. 1 to no. 10 refers to community types in Sorbus commixta - natived forests. **= standard deviation. Companion of 411 spp. omitted.

the species group 17 as character species. According to Horikawa & Sasaki (1959), this community can be identified with the *Iliceto - Tsugetum sieboldii*. It is a natural forest developed on ridges or prominence sites of the mountain. This is further subdivided into two lower units of the *Polypodium vulgare - Camellia japonica* group and typical group by the presence of the differential species group 18. The *P. vulgare - C. japonica* group is developed on the lower part of the mountain where human influence is a slight. A typical group is developed on a ridge or prominence of the mountain where human influence is not as strong.

3.2. Ecological characteristics

3.2.1. Coverage by stratum

Compared to the total cover (trees, subtrees, shrubs

Table 2. Simiarity Matrix for Vegetation Units (VU)

VUs	1	2	3	4	5	6	7	8	9	10
1										
2	16.11									
3	57.02	51.48								
4	18.43	42.42	58.77							
5	24.27	35.31	52.41	66.61						
6	18.31	41.11	53.23	71.89	65.76					
7	13.21	8.03	10.08	12.16	23.36	13.28				
8	14.51	8.12	8.44	11.45	17.47	12.81	81.52			
9	17.16	8.08	8.21	12.51	26.33	10.00	75.61	70.11		
10	17.38	7.16	7.36	12.03	27.27	8.28	60.02	61.36	78.41	

Table 3. Diversity index of the vegetations units on VT I and VT II

Vegtation Units	1	2	3	4	5	6	**VT I**	7	8	9	10	**VT II**	**Total**
Richness (S)	16.5	19.7	23.4	24.9	27.3	38.6	**25.1**	18.1	18.3	16.8	12.0	**16.3**	**21.6**
Diversity (H')	1.57	1.90	1.65	2.25	1.76	2.14	**1.88**	1.82	1.92	1.79	1.61	**1.79**	**1.84**
H'max	2.80	2.98	3.15	3.21	3.31	3.65	**3.22**	2.90	2.91	2.82	2.48	**2.79**	**3.07**
Evenness (E)	0.56	0.64	0.52	0.70	0.53	0.59	**0.58**	0.63	0.66	0.63	0.65	**0.64**	**0.60**
Dominance (D)	0.44	0.36	0.48	0.30	0.47	0.41	**0.42**	0.37	0.34	0.37	0.35	**0.36**	**0.40**

and herbs) by each vegetation unit, the highest cover is encountered in vegetation unit no.2 (215.2%). The total cover in the VT I and in the VT II is also the same (181.4 and 166.9%, respectively). Compared to the average cover of the four strata, VT I consists of the upper 68.6%, lower 22.5%, shrubs 35.9%, and herbs 39.9% and VT II, the upper 82.1%, lower 34.4%, shrubs 29.2%, and herbs 35.7%, respectively. VT II was 20% to 30% greater than VT I. This is because VT I has various sites whereas VT II is limited to sites on the top or on ridges.

3.2.2. Community similarity

Table 2 shows the similarity of the component species among the vegetation units. The similarity coefficient (CCs) between the two-vegetation types shows less than 20% similarity. This means that the similarity of the two groups is almost nonexistent. VT I, except vegetation unit 1, showed quite a different composition from other vegetation units; the similarity among the vegetation units appeared to be mostly about 50 % and so they were considered as identical communities. In the VT II, the similarity among the vegetation units appeared to be over 70% and they were considered as identical communities. A low similarity between strata and stands indicates microclimatic variations and hence a different species composition. Wikum and Wali (1974) and Saxena and Singh (1982) have pointed out the significant role of site characteristics in plant distribution and similarity.

3.2.3. Interspecific correlations

In each life-form, 120 correlations were positive with 23 of these having p-values 0.01 for trees, 21 for shrubs, 10 for vines, and 25 for herbs, respectively. In trees, a positive correlation was found between *S. commixta* and *A. takesimense* and *T. insularis* ot the 1% level and between *F. crenata* var. *multinervis* and *P. parviflora* at 5%. A negative correlation was found between *S. commixta* and inland type species such as *A. koreana*, *P. densiflora*, and *Acer tschonoskii* var. *rubripes* at the 5% level. In shrubs, a positive correlation was found between *S. commixta* and *Sasa kurilensis*, *Callicarpa japonica*, *Ligustrum foliosum* at the 5% level and there was a negative correlation between *S. commixta* and *R. mucronulatum* and *R. schlippenbachii* at the 1% and 5% level, respectively. In woody vines, there was a negative correlation between *S. commixta* and *Tripterygium regelii* and *Actinidia rufa* at the 1% level. In herbs, there was a positive correlation between *S. commixta* and *Majanthemum dilatatum*, and *Allium victorialis* var.

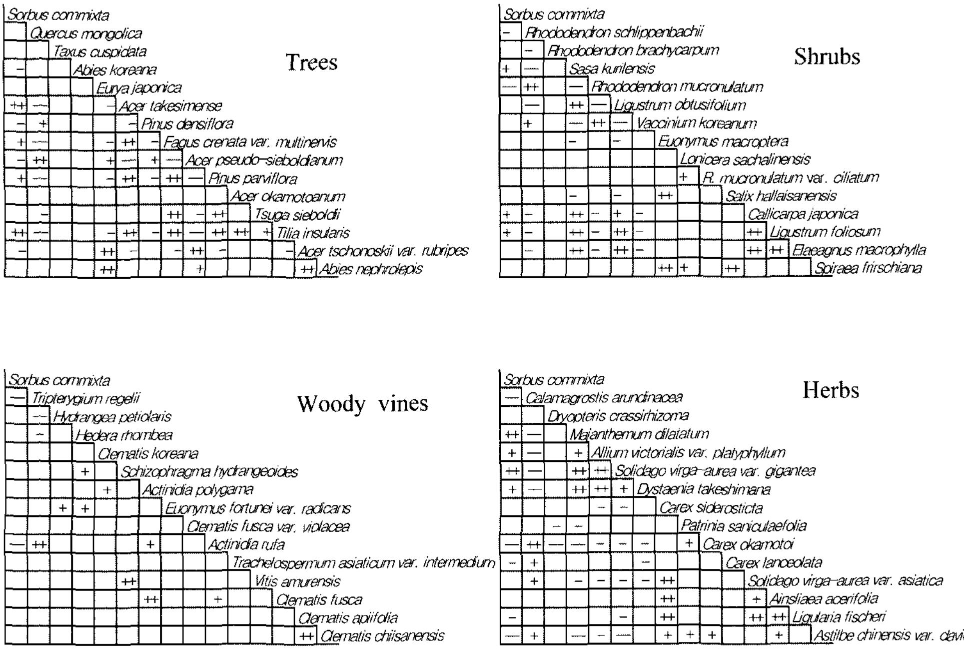

Fig. 2. Complete chi-square matrix for 20 species by life forms in the study area. Spearman's rank correlation coefficient is used (Clarke 1994); Positive and neative correlations are given with two levels of probability: + or -: P≤0.05; ++ or --: P<0.01.

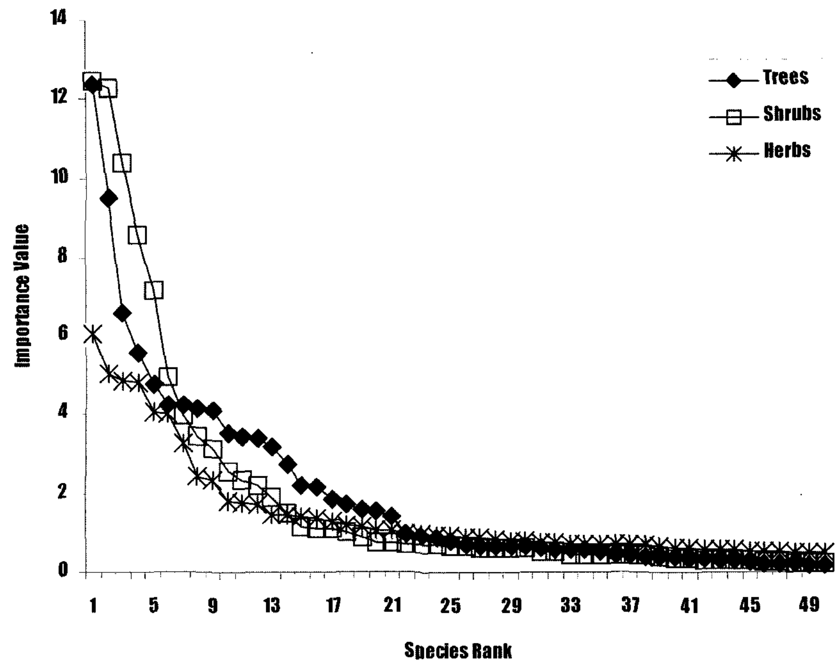

Fig. 3. Relations bewteen IV and Species Rank of *S. commixta*-native forests.

platyphyllum at the 1 % and 5 % level, respectively (Fig. 2).

3.2.4. Importance values and constancy classes

In total IV, *S. commixta* - natived forests of our

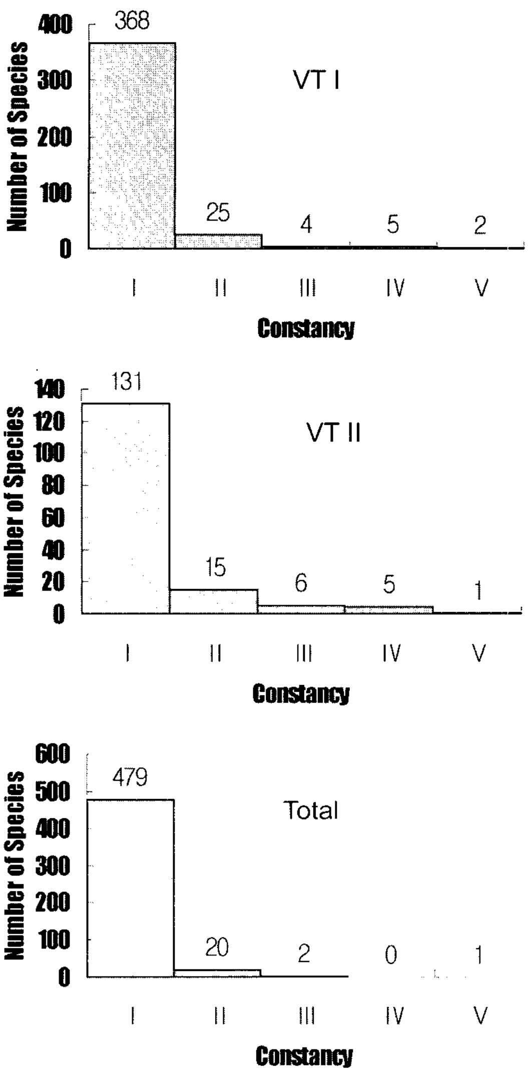

Fig. 4. Constancy diagrams of the vegetation types.

country exhibit a pattern of weak dominance (Fig. 3), meaning that no single species had an importance value greater than 25%. In trees, only *S. commixta* had IVs of 10% or greater. In shrubs, *R. schlippenbachii, R. brachycarpum,* and *Triptergium regelii* had IVs of 10% or greater. Both *S. commixta* and *A. koreana* had relatively higher IVs than other species. The next dominant species were *T. cuspidata, Q. mongolica,* and *P. parviflora*. These had high IVs due to their high frequency. For the mid-constancy classes (III), the number of the component species does not differ from each other. However, in the total ratio of the component species, VT II is three times as abundant as VT I. This shows that VT II has greater variability of site conditions than VT I. In total constancy classes, the lower classes (≤II) have 99.4% of the forest plants occurring in this area, the mid-classes (III) 0.4%, and the higher classes (≥IV) have only 0.2%.

3.2.5. Species diversity

Diversity is a combination of two factors: the number of species present, referred to as species richness, and the distribution of individuals among the species, referred to as evenness or equitability. Single species populations are defined as having a diversity of zero, regardless of the index used. Species diversity, therefore, refers to the variations that exist among the different forms. In the present study the Shannon -Wiener index of diversity has been used.

The average number of species per unit area (/100 m^2) was 22.4±9.3. VT I is more abundant, 10 kind, than VT II. Compared to the component ratio of species by life-forms, a difference did not exist, particularly in two vegetation types. They consist of trees 20.5%, subtrees 14.3%, shrubs 18.3% and herbs 46.9%. The average number of species was most abundant in the VT 6 vegetation type I. The total number and diversity of species were higher in the inland type. The value of diversity ranged from 1.57 to 2.25 for vegetation units. The range of diversity in the inland forest is certainly higher than the Ulreung Island type; however, it is lower than reported for other forests in Korea. The value of species richness ranged from 12.0 to 38.6 for vegetation units.

적 요

남한지역의 마가목 자생임지를 대상으로 군락생태학적 측면에서 ZM학파의 식물사회학적 방법을 적용하여 그 식생조성과 구조가 연구되고, 추출된 각 식생단위에 대한 몇 가지 생태학적 특성(층별 피도, 종상관, 군락유사성, 상대중요치, 군락다양성, 군락상재도 등)이 분석되었다. 남한지역에서의 마가목 자생임지의 식생유형은 크게 내륙고산의 미역줄나무-신갈나무형(군락군수준)과 울릉도의 섬단풍-너도밤나무형(군락군수준)으로 구분되었으며, 10개의 식생단위가 수반되었다. 생육형별 종상관에서는 120개의 상관 중 교목은 23개, 관목은 21개, 만목은 10개 그리고 초본은 25개가 ≤1% 수준에서 정의 관계를 나타내었다. 마가목을 중심으로 한 생육형별 종상관을 보면, 교목류는 섬단풍, 섬피나무 등이≤1%, 관목류는 섬조릿대, 작살나무, 섬쥐똥나

무 등이≤5%, 만목류는 미역줄나무, 다래 등이≤1%, 그리고 초본류는 큰두루미꽃, 울릉미역취 등이≤41% 유의수준에서 각각 정의 관계를 나타냄을 알 수 있었다. 본 연구 결과는 향후 한국산 마가목의 자연지리적 연구와 유용자원식물인 마가목의 지속가능한 보전과 이용에 있어서 효율적인 자료로 활용될 것으로 판단된다.

REFERENCES

Braun-Blanquet, J., 1964: *Pflanzensoziologie, Grundzüge der Vegetationskunde.* 3 Aufl. Springer, Wien, 865pp.

Clarke, G. M., 1994: *Statistics and Experimental Design: An Introduction for Biologists and Biochemists* (3rd ed.). London. Edward Arnold, 357pp.

Horikawa, Y. and Y. Sasaki, 1959: Vegetation und Flora der Bihoku-Gegend, Provinz Hirhoshima. Chugokusanchi-Kokuteikoen-Kohochi. Hiroshima, 43-68.

Knapp, R., 1971: *Einflihrung in die Pflanzensoziologie.* Verglag E. Ulmer, Stuttgart.

Lee, C. B., 1985: *Illustrated Flora of Korea.* Hyangmoonsa, Seoul. 990pp (In Korean).

Mueller-Dombois, D. and H. Ellenberg, 1974: *Aims and Methods of Vegetation Ecology.* New York. John Wiley, 525pp.

Peet, R. K., 1974: The measurement of species diversity. *Annual Review of Ecology and Systematics,* **5**, 285-307.

Saxena, A.K. and J. S. Singh, 1982: A phytosociological analysis of woody species in forest communities of a part of Kumaun Himalaya. *Vegetatio,* **50**, 3-32.

Shimwell, D. W., 1971: *The Description and Classification of Vegetation.* Sidgwick and Jackson, London, 322pp.

USDA Forest Service. 1989: Proceedings of the Conference on Land Classifications Based on Vegetation: Applications for Resources Management, Ogden, UT: U.S. Forest Service Intermountain Research Station, General Technical Report INT-257, 315pp

Wikum, D. A. and M. K. Wali, 1974: Analysis of a North Dakota gallery forest: vegetation in relation to topographic and soil gradients. *Ecological Monographs*, **44**, 441-464.