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Surveys of Vegetation in the Peninsular Geography of Youngweol

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Abstract - We have investigated the vegetation in the peninsula located in Ongjeong-Li Seomyeon in Youngweol-gun. Since this is a limestone area, boxtrees, *Abelia mosanensis* T. H. Chung ex Nakai, and *Selaginella stauntoniana* Spring were abundant, as these are types of vegetation characteristic of limestone areas. *Pinus densiflora* S. et Z. was the most dominant woody plant, but vegetational changes, such as the dominance of *Quercus variabilis* Blume, *Quercus dentata* Thunb, and *Quercus mongolica* Fischer, were observed in spots. In particular, the growth of nursery plants of *pinus densiflora* S. et Z. was not observed, and young trees like *Quercus mongolica* Fischer grow as low vegetation of *Pinus densiflora* S. et Z.. Thus, the ecological succession of *Quercus mongolica* Fischer is predicted. Outside the investigation area, as herbaceous plants, various vegetations were observed, including Selaginella stauntoniana Spring, *Thalictrum coreanum* H. Lev., *Mukdenia rossii* (Oliv.) Koidz., *Platanthera freynii* Kraenzl., *Cephalanthera longibracteata* Blume, *Potentilla dickinsii* Franch., *Patrinia rupestris* (Pall.) Juss., *Swertia pseudochinensis* H. Hara, *Vicia venosa* (Willd.) Maxim., *Pyrola japonica* Klenze ex Alef., *Disporum smilacinum* A. Gray, *Artemisia stolonifera* (Maxim.) Kom. for. Stolonifera, *Smilax nipponica* Miq., *Adenophora triphylla* var. japonica (Regel) H. Hara, *Isodon inflexus* (Thunb.) Kudo, *Gentiana scabra* Bunge for. Scabra, *Polygonatum odoratum* var. pluriflorum (Miq.) Ohwi, *Dioscorea quinqueloba* Thunb., *Syneilesis palmata* (Thunb.) Maxim., *Asparagus schoberioides* Kunth, *Eupatorium japonicum* Thunb. ex Murray, *Galium kinuta* Nakai & Hara, *Saxifraga fortunei* var. incisolobata, *Lilium amabile* Palib., *Siberian iris*, *Dictamnus dasycarpus* Turcz., *Atractylodes ovata* (Thunb.) DC., and *Lysimachia clethroides* Duby.

Key words - Vegetation, Peninsular, Geography, Youngweol, Limestone

Introduction

Youngweol is a typical limestone area, and it has many renowned sites, with a characteristic geography weathered by water. The investigated area is a sightseeing place with the same geographical shape as that of the Korean peninsula, due to the erosion of the limestone by river water over a long period of time. The east side of the peninsula features cliffs, where the limestone is severely eroded by the river water, and the south and the west sides form smooth slopes, which closely resemble the geographical shape of Korea. At first glance, the area seems to be covered by pine forests. However an actual investigation of the forest shows many diverse types of vegetation, including multiple types of vegetations in the limestone area. Many researchers (Kwak, 1993; Lee *et al.*, 1970; Choi, 1996) have performed analysis of the calcicolous plant species among the vegetation in the limestone areas as well as the distribution of plants in limestone areas. Jung *et al.* (2003) reported regarding the characteristics of the existing vegetations growing in Danyang, which is a representative limestone area, and the limestone area of Youngweol. However, thus far there have been no investigations carried out on the vegetation of the Youngweol peninsula. This study aims to examine the future directions of the growth of vegetation in this area, with a focus on woody plants as well as general vegetation in the investigated area.

Materials and Methods

Vegetation analysis

The investigation area is located in Ongjeong-li Youngweol-gun in Kangwon-do, and the site exploration was carried out in August 2007. By selecting 3 spots in the peninsula region, the community examination of the vegetation was carried out to assess species dominance and sociability, according to the Braun-Blanquet method (Kim *et al.*, 1987). In the investigation area (Fig. 1), spots with representative vegetational structure have been selected, and Plot of 20×20m was set for investigation. Within the Plots where the species structure of the community was investigated, trees with a breast height diameter greater than 10cm were measured for their

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breast height diameters. In this investigation, woody plants were the primary targets for investigation, but species identification of herbaceous plants in the investigation area was performed, with reference to the Lineamenta Flora Koreae (Lee, 1996).

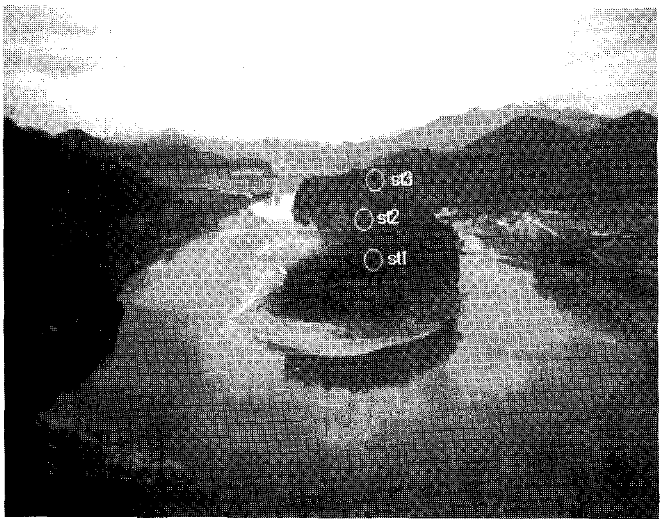

Fig. 1. Investigation area of peninsula geography.

Ordinal cover was converted to the median value of percent cover range in each cover class by 12 grades. Important value of each species was calculated by sum of relative frequency and relative coverage of each species (Curtis and McIntosh, 1951). Environmental Factors were investigated for each plots: altitude, slope, radiation level, topography, Rock level etc. the plots and species were arranged acording to the environmental factors by Nonmetric Multidimensional Scaling (NMS). all statistical analysis was performed using PC-Ord version 5. Species cover was transformed by arcsine-aquare root.

Results and Discussion

Site 1 of the investigation area is located at the upper part of the slopes, and its vegetation type was *pinus densiflora* S. et Z.s, with a tall tree layer of *pinus densiflora* S. et Z., and subtree layer is composed of *Quercus mongolica* Fisch, *Prunus sargentii* Rehder, *Acer pictum* subsp, *Juniperus rigida* Siebold, and *Fraxinus rhynchophylla* Hance. Site 2 is located at the west side of the peninsula, which forms a sharply slanted face from the upper part of the slopes, and here *Quercus variabilis* Blume - *Quercus dentata* Thunb are dominant, and as subtree layer, *Quercus dentata* Thunb, *Quercus variabilis* Blume, *Juniperus rigida*, and *Sorbus alnifolia* are growing, and in the bush layer, *Quercus variabilis* Blume, *Lespedeza maximowiczii* C. K. Schneid, *Suffrutescent suffruticosa* Rehder, Davurian Buckthorn, and box trees were growing. In site 3, *Pinus densiflora* S. et Z. are growing as tall trees and, as subtree layer, small numbers of *Quercus mongolica* Fisch, *Acer pictum* sub, and Konara oak were growing. The vegetational characteristics of the investigation area were that *Pinus densiflora* S. et Z. were growing as the most dominant species, and, in certain areas, *Quercus variabilis* Blume, *Quercus dentata* Thunb, and *Quercus mongolica* Fisch appeared to have broadened their area. In the investigation area, box trees and Buxus koreana were evenly distributed overall, which shows that this is an area of lime stones. Analysis results of diameter distribution for woody plants within the investigation area are shown in Fig. 1.

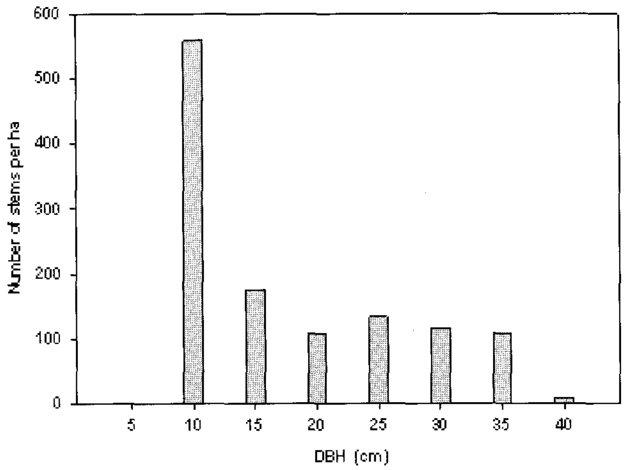

Fig. 2. Diameter structure of woody species.
($\geq$5 cm in DBH) within the study area.

As shown in Fig.1, diameters of 10cm were dominant, and wider diameters showed reverse J-type distribution, diminishing in their numbers. Since it has been known that stable forests have reverse J-type distribution, the discovery of reverse J-type in the investigation area tells us that this is a relatively stable forest. (Kim, 2004).

The diameter distribution analysis for the major dominant species, *Pinus densiflora* S. et Z., *Quercus mongolica* Fischer, *Quercus variabilis* Blume, and *Quercus dentata* Thunb, of site 1～site 3 in the investigation is shown in Fig. 2. As shown in Fig. 2, *Pinus densiflora* S. et Z. of 25cm diameter was highest in its number, while there was a gradual decrease in numbers with diameters greater than 25cm, and a sharp decrease innumbers with diameter below 25cm. However, *Quercus mongolica* Fischer, *Quercus variabilis* Blume, and *Quercus dentata* Thunb did not have

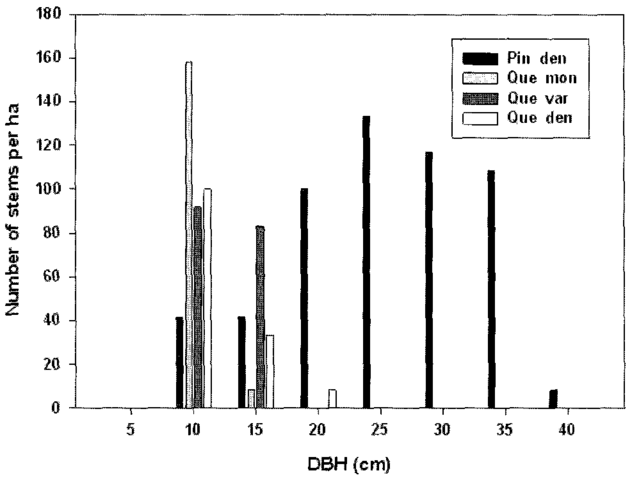

Fig. 3. Diameter structure of some dominant species (≥5cm in DBH) within the study area.

trees with diameter greater than 25cm, while trees with diameters below 20cm showed an increasing trend, and smaller trees with diameters of 10cm were prevalent. As observed here, *Pinus densiflora* S. et Z. in Youngweol peninsula is expected to change into *Quercus mongolica* Fischer as ecological succession proceeds, and *Quercus variabilis* Blume, and *Quercus dentata* Thunb are expected to continually produce, expanding their territory. (Kim, 2004).

Table 1 shows the RF (Relative frequency), RC (Relative Cover), and IV (Importance value) for the species of the investigated sites. Proceeding in order of the greatest to least importance value (IV), there are *Pinus densiflora* S. et Z., *Quercus variabilis* Blume, *Quercus mongolica* Fischer, *Juniperus rigida* Siebold, *Festuca ovina* L. var. ovina, boxtree, *Fraxinus rhynchophylla* Hance, *Sorbus alnifolia*, *Quercus dentata* Thunb, and *Abelia mosanensis* T.H. Chung ex Nakai. Among these, boxtree and *Abelia mosanensis* T.H. Chung ex Nakai are characteristic vegetation of lime stone areas. The RC (Relative cover) value shows a similar trend with the IV,in the order of pinus densiflora S. et Z., *Quercus variabilis* Blume, *Quercus mongolica* Fischer, *Juniperus rigida* Siebold, boxtree, *Fraxinus rhynchophylla* Hance, *Sorbus alnifolia*, *Quercus dentata* Thunb, and *Abelia mosanensis* T.H. Chung ex Nakai. RF value shows equivalent frequencies of 1.8 for *Pinus densiflora* S. et Z., *Quercus mongolica* Fischer, *Juniperus rigida* Siebold, *Quercus dentata* Thunb, *Abelia mosanensis* T.H. Chung ex Nakai, and *Fraxinus rhynchophylla* Hance, and 1.2 for *Quercus variabilis* Blume and *Sorbus alnifolia*, with boxtree following next.

Out of the sites investigated, species numbers and abundances were highest in St 1 of *Pinus densiflora* S. et Z., followed by St 3, and the smallest numbers of species were observed in St 2 of *Quercus variabilis* Blume - *Pinus densiflora* S. et Z. In addition, evenness of *Pinus densiflora* S. et Z. was highest in St 3, followed by St 1 and St 2. The diversity coefficient was highest in St 1, and lowest in St 2. The reasons for low species numbers, abundance, evenness, and diversity coefficient were thought to be the facts that the slopes were steep and *Quercus variabilis* Blume and *Quercus mongolica* Fischer, which are broadleaf forests, blocked the light, hindering the growth of vegetation.

Fig. 4 shows the analysis of the relationship between the investigation sites and location factors using Nonmetric Multidimensional Scaling (NMS), which is one of the ordinations. (McCune and Grace, 2002) Site 2 was located on highly steep slopes

Table 1. Important value of species at study sites

Species	RF[1] (%)	RC[1] (%)	IV[2] (%)
Pinus densiflora	1.8	16.4	9.1
Quercus variabilis	1.2	14.2	7.7
Quercus mongolica	1.8	10.8	6.3
Juniperus rigida	1.8	8.1	5.0
Carex humilis Leyss. var. *nana*	1.8	7.4	4.6
Buxus microphylla var. *insularis*	0.6	8.3	4.5
Fraxinus rhynchophylla	1.8	4.3	3.1
Sorbus alnifolia	1.2	3.6	2.4
Quercus dentata	1.8	2.3	2.1
Abelia mosanensis	1.8	2.1	2.0

[1]RF: Relative frequency, RC: Relative cover.
[2]Important value(IV) ≥2.0 is shown.

Table 2. Species richness, evenness and diversity at plot

Plot	No. of species	Richness[1]	Evenness[2]	Diversity[3] (Shannon's)	Diversity[4] (Simpson's)
St 1	61	61	0.90	3.71	0.96
St 2	44	45	0.88	3.34	0.94
St 3	56	57	0.91	3.66	0.96

[1]Richness: $D = \frac{S}{\sqrt{N}}$, [2]Evenness: $\frac{H'}{\log eS'}$, [3]Diversity(Shannon's): $-\Sigma \Pi \log \Pi$, [4]Diversity(Simpson's): $D = 1 - \sum_{i}^{s} \Pi^2$

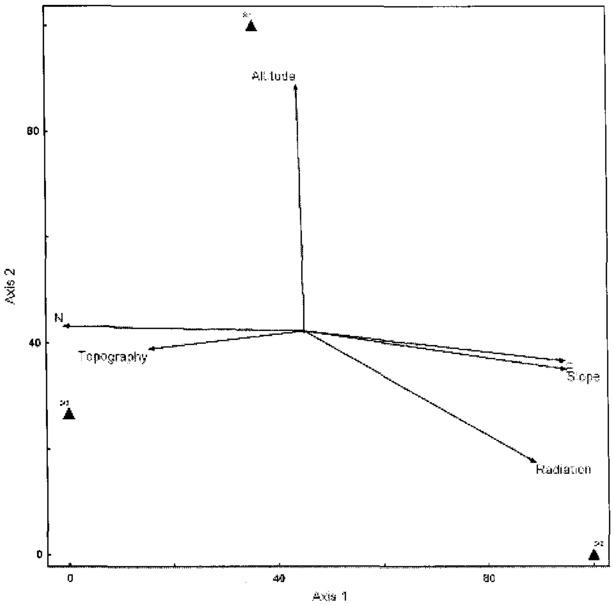

Fig. 4. Stand ordination by NMS and some significant site factor.

and on slopes that were further south thanother investigation sites, which caused dryness. Therefore, species that could thrivein dry conditions, such as *Quercus variabilis* Blume, were predominant. Site 1 was highest in its altitude, and site 3 was the lowest.

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