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<Short Communication>

A Phytosociological Description of the *Abies koreana* Forest on Mt. Halla in Cheju Island, Korea

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한라산 구상나무림에 대한 식물사회학적 연구

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ABSTRACT

The floristic composition of the Korean-fir(*Abies koreana* Wilson) forest on Mt. Halla in Cheju Island, Korea, was described and some other phytosociological features were noted.

The dense tree layer of the *Abies koreana* forest under consideration attained a height of no more than 5~7m. The shrub layer was 1.2~2m high and usually inconspicuous, while the herb layer, 0.3~0.5m high, was remarkable.

The forest contained a number of species which are characteristic of the subalpine coniferous in Japan, particularly that in Hokkaido. Moreover, the specific synchronized regeneration called wave-regeneration was found in the forest on Mt. Halla at several sites even though the data on this phenomenon do not present in the present report.

Key words : Korean-fir, Subalpine coniferous forest, Synchronized wave-regeneration

INTRODUCTION

Description of plant communities, in particular the composition of species, is fundamental to the phytosociological study of vegetation. However, there have been few studies from that point of view in Korea.

We surveyed the Korean-fir (*Abies koreana* Wilson) forest on Mt. Halla in Cheju Island situated at about 100km from the southern tip of Korean peninsula, in July of 1982. Mt. Halla is a volcanic mountain which rises at the center of the island, 32° 20′ N. and 126° 30′E., and attains a height of 1,950m above sea level.

Several workers have described the vegetation zones of Mt. Halla (Uhm 1962, Cha 1964, Oh and Kim 1977, Song and Nakanishi 1985, Song 1991). Even though each result differs in the methodology, the following three basic vegetaion zones are distinguishable according to their results : 1) the evergreen broad-leaved forest zone, 2) the deciduous broad-leaved forest zone and 3) the evergreen coniferous forest zone. The *Abies koreana* forest is a representative of plant communities comprising the third zone which corresponds to the subalpine vegetation zone in the subarctic climate.

This paper is concerned with species composition and some phytosociological features of the forest.

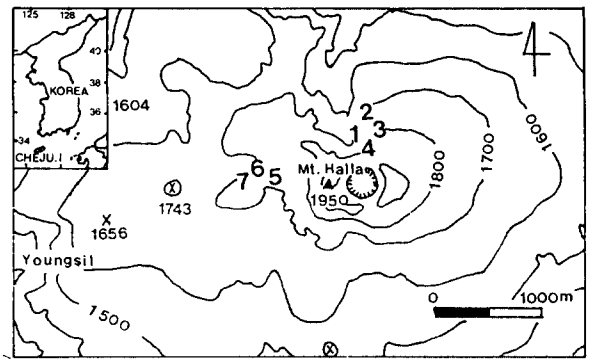

Fig. 1. A map showing the area surveyed on Mt. Halla, Cheju Island. For the numbers of the plots refer to the Tables 1 and 2.

METHOD OF DESCRIPTION

Seven stands of the *Abies koreana* forest were selected along a path running from the northern foot up to the summit and then down to the southern foot of Mt. Halla (Fig. 1). A sample plot with homogeneous ecological conditions and exceeding minimal area of the forest was laid in each stand and the plot area surveyed was 400m² in each stand.

The forest structure of each stand was described with respect to layering into strata and the percent of the foliage cover of each stratum was estimated. The species within each stratum were listed and then the quantity of each species as estimated by their cover-abundance scale values in terms of Braun-Blanquet (1964) were recored. Sociability was also estimated by means of the Braun-Blanquet value scale (1964). Constancy in a scale of five values was calculated for each species based on the occurrence of the species through all layers in a plot.

RESULTS AND DISCUSSION

The canopy of the *Abies koreana* forest on Mt. Halla was sometimes open in several sites. On such places, *Sasa quelpaertensis* was dense in the shrub layer and the number of species tended to be reduced. So, stands having continuous canopies were selected for investigation. However, the tree layer in such stands attained a height of no more than 5~7m and the subtree layer was not recognizable in every stand.

The cover of the tree layer was 80~90 percent (Table 1). It was heavily dominated by *Abies koreana* and contained the needle-leaved *Taxus cuspidata* and several deciduous broad-leaved trees such as *Prunus maximowiczii*, *Sorbus commixta* and *Betula ermanii* (Table 2).

The shrub layer was 1.2~2m high and usually inconspicuous. Its cover was as low as 5~20 percent. It consisted mainly of stunted individuals or juveniles of the common species comprising the tree layer, along with a few shrubs such as *Berberis amurensis* and *Lonicera caerulea* var. *edulis*. However, the herb layer, 0.3~0.5m high, was remarkable and 30~60 percent in cover. It contained many species of its own (Table 1 and 2).

Sasa quelpaertensis was dwarfed and not numerous under

Table 1. Brief description of habitat and height stratification of the *Abies koreana* forests on Mt. Halla, Cheju Island. The area surveyed was 400m² in each plot

Plot number	1	2	3	4	5	6	7
Altitude(m)	1,670	1,680	1,740	1,780	1,710	1,710	1,710
Exposure	N60°W	N30°W	N60°W	N30°W	–	N30°E	N20°E
Inclination(°)	15	15	25	10	10	25	10
Stratification height (m)							
Tree layer	7.0	7.0	6.0	6.0	5.0	6.0	6.0
Shrub layer	1.5	1.5	1.8	1.2	1.3	1.5	2.0
Herb layer	0.3	0.4	0.5	0.3	0.3	0.3	0.4
Cover(%)							
Tree layer	90	80	90	90	80	90	80
Shrub layer	10	10	20	5	10	5	20
Herb layer	40	50	50	30	30	60	60

Table 2. Floristic composition of the the *Abies koreana* forest on Mt. Halla in Cheju Island, Korea. A pair of numerals shows cover-abundance scale value(former) and sociability(latter). Ten species with a constancy value of I were omitted from the table. For the dots without constancy vlues refer to the same species in the upper layer

Layer species	Plot 1	2	3	4	5	6	7	Constancy
Tree layer								
Abies koreana	5.5	5.4	5.5	5.5	4.4	5.4	5.5	V
Prunus maximowiczii	1.1	1.1	1.1	1.1	1.1	1.1	1.1	V
Taxus cuspidata	.	.	2.1	1.1	2.1	2.2	+	V
Sorbus commixta	.	+	+	1.1	.	.	.	III
Hydrangea petiolaris	.	.	+	+	.	.	.	III
Betula ermanii	1.1	1.1	.	.	.	.	.	II
Smilax china	.	.	.	.	.	+.2	.	III
Shrub layer								
Taxus cuspidata	1.1	2.1	1.2	+	1.1	1.1	2.1	.
Berberis amurensis	.	.	+	.	1.1	1.1	+	IV
Prunus maximowiczii	1.1	.	+	.	.	+	+	.
Abies koreana	.	.	1.1	.	.	.	1.1	.
Lonicera caerulea	.	+	1.2	.	.	.	.	II
Sorbus commixta	.	+	+	.	.	.	.	.
Lonicera maackii	+	.	.	.	.	.	.	IV
Hydrangea petiolaris	.	+	.	.	.	.	.	.
Herb layer								
Sasa quelpaertensis	1.2	2.2	1.2	+.2	1.2	2.2	1.2	V
Circaea alpina	+.2	+.2	1.2	1.2	2.2	1.2	2.2	V
Galium kamtschaticum	1.2	+.2	+.2	+.2	2.2	1.2	1.2	V
Carex sp.	+.2	1.2	1.2	+.2	+.2	2.2	1.2	V
Cacalia auriculata	1.2	1.2	+.2	1.2	+.2	+	1.2	V
Maianthemum bifolium	1.2	+.2	+.2	+.2	+.2	+.2	+.2	V
Asiasarum heterotropoides var. *seoulense*	+	+.2	+	+	1.2	+	+	V
Lycopodium serratum	.	1.2	1.2	2.2	+.2	1.2	2.2	V
Dryopteris crassirhizoma	.	+.2	1.1	+	1.1	+	1.1	V
Clintonia udensis	+	.	+	+	1.1	+	+.2	V
Lycopodium chinense	.	+.2	+.2	+.2	+.2	+.2	+	V
Asiasarum maculatum	1.2	+	+	+	.	.	+	IV
Pternopetalum tanakae	+	+	.	+.2	.	+	+.2	IV
Bistorta suffulta	+	.	+.2	.	.	1.2	1.2	III
Oxaris acetosella	.	.	+	+.2	.	1.2	1.2	III
Phegopteris polypodioides	.	.	+	+.2	.	1.2	1.2	III
Anemone stolonifera	.	.	.	+	1.2	1.2	+	III
Carex sp.	+.2	+.2	+.2	1.2	.	.	.	III
Polystichopsis miqueliana	.	.	+.2	1.2	.	+	+	III
Viola boissieuana	.	.	.	+	1.2	+.2	+	III
Smilax china	.	.	+.2	+.2	.	+	+	.
Lonicera maackii	.	.	+	+	.	+.2	+	.
Athyrium yokoscense	.	.	+	.	+.2	+	+	III
Thalictrum punctatum	.	+	+	+.2	.	.	+	III
Taxus cuspidata	.	.	.	+	+	+	+	.
Prunus maximowiczii	.	.	.	+	+	+	+	.
Berberis amurensis	.	.	+	+	+	.	+	.
Disporum smilacinum	+	.	+	+	.	+	.	III
Primula jesoana	.	.	+.2	.	.	1.2	+	III
Potentilla sp.	+	.	.	+	.	.	+.2	III
Euonymus alatus var. *subtriflorus*	+	.	.	.	.	+	+	III
Chimaphila japonica	+	+	.	.	+	.	.	III
Dryopteris austriaca	.	+	+	+	.	.	.	III

Layer species	Plot 1	2	3	4	5	6	7	Constancy
Arisaema amurense var. *serratum*	.	.	+	+	.	+	.	III
Hosta longipes	.	.	.	.	1.2	.	1.2	II
Hepatica asiatica var. *acutiloba*	1.2	+	.	.	.	.	.	II
Carex siderosticta	.	.	1.2	.	.	.	+	II
Viburnum furcatum	1.1	.	.	+	.	.	.	II
Carex sp.	.	.	.	.	+.2	+.2	.	II
Calamagrostis sp.	.	.	.	+	+.2	.	.	II
Rosa koreana	.	.	.	+.2	.	.	+	II
Solidago virgaurea	+	.	.	+	.	.	.	II
Viola sp.	.	+	.	.	.	.	+	II
Plantago asiatica	.	.	.	.	+	.	+	II
Sorbus commixta	.	.	.	+	.	.	.	.
Hydrangea petiolaris	.	1.2	.	.	.	.	.	.
Total number of species	39	29	33	36	25	32	44	

the continuous canopy. Nevertheless, it was one of the most frequently observed species in the herb layer.

Suzuki (1966) emphasized that the joint occurrence of an over-growth of Pinaceae and an undergrowth of Ericaceae is the most characteristic feature of the floristic composition of the subalpine coniferous forest of Japan. In contrast, the *Abies koreana* forest on Mt. Halla contained no ericaceous species. In spite of that, the *Abies koreana* forest contained a number of species which are characteristic of Japanese subalpine forests, the floristic composition of which has been synthesized by Jinno and Suzuki (1973) ; those were *Betula ermanii, Sorbus commixta, Viburnum furcatum, Dryopteris austriaca, Lycopodium serratum* and *Oxaris acetocella.* Besides these species, it also contained several species such as *Maianthemum bifolium, Circaea alpina, Dryopteris crassirhizoma* and *Galium kamtschaticum* which are characteristic of the same kind of forest in Hokkaido.

As one of the noteworthy features at the the *Abies koreana,* there were wave-regenerated stands on at least three sites on Mt. Halla (Fig. 2 and 3). An extreme example was found on the inside slope of the crater facing north at the summit, where several white stripes of dead and dying trees and vigorous saplings were seen in the green canopy area of the *Abies koreana* forest. This specific synchronized

Fig. 2. White stripes of dead and drying trees and vigorous saplings in wave-regenerated stand on the inside of the crater in MT. Halla.

Fig. 3. Fallen dead trees by uprooting in the wave-regenerated stand.

regeneration of high-altitude coniferous forests was studied at an early date on mountains in Central Japan (Oshima *et al.* 1958, Iwaki and Totsuka 1959, Kohyama 1981, 1982 *et al.*), and Yoshino (1976) stated that the phenomenon was limited to that area.

However, the same phenomenon was also described for the *Abies mariesii* forest on Mt. Hakkoda near the northern end of Honshu Island (Tohda and Kikuchi 1981) and the *Abies sachalinensis* coastal forest in northern Hokkaido (Sato 1994). Furthermore, Sprugel (1976), Reiners and Lang (1979) reported a similar regeneration in the northeastern United States. It is noteworthy that such wave-regeneration is also found in Korea. The detailed description on this phenomenon was presented in other report (Kang 1989).

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적 요

제주도 한라산 구상나무 (*Abies koreana*)림의 식생조성을 기재하고 또 몇 가지 식물사회학적 특징을 알아보았다.

본 조사지에서 고목층인 구상나무임의 수고는 5~7m이었고, 저목층의 높이는 1.2~2m로 뚜렷한 계층을 나타내지 않았으나, 초본층의 높이는 0.3~0.5m로서 뚜렷한 층을 형성하고 있었다.

한라산의 구상나무림은 일본의 침엽수림과 비교할때, 특히 북해도 지방의 아고산대 침엽수림에서 특징적으로 나타나는 종들이 많이 출현하고 있었다.

특히 아고산대에 있어서 특이한 갱신과정의 한 양식인 Synchronized wave-regeneration을 한라산 구상나무림의 몇 지소에서 관찰할 수 있었다는 것은 특기할 만한 것이다.

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