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Phyto-Sociological Study of Resource Plant in Mt. Daedun

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ABSTRACT

Through the research of tracheophytes type around Mt. Daedun, we are aiming at figuring out the habitat condition of useful resource plants by the classification of vegetation units and communities using the Z-M phyto-sociological method in the basis of the traits of species composition and by the analysis of vegetation and environment by way of coincidence method. Tracheophytes in our research sites was classified into 117 family, 475 genus 797, species 102 variety, 18 breed, in total to 917 kinds. The forest around Mt. Daedun district was classified into 6 communities, 12 groups, 2 sub-groups according to feature species group, differential species group and differential. Judging the result from the examination of community classification factors by the coincidence method, vegetation unit was decided by altitude and topography.

Key word : resource plant, Z-M phyto-sociological, coincidence method

INTRODUCTION

As always, forest is an ecosystem which forms correlation with life species and surrounding conditions that constitutes it. It makes the continual usage of natural resources possible by means of efficient preservation and control of nature, and in the case we fail to conserve and control it, however recyclable they are, it will lead to unreturnable situation. Life diversity and habitat preservation, which are natural resources, are the greatest emergent subject which should be solved in present society.

For natural resources investigation, preservation and upbringing, it is thought that the study on plant resources and understanding of cluster characteristics, as they are the main constitutional factors of nature, should be performed in advance.

Vegetation rarely lives alone, but many species forms a community under a certain circumstances (kerbs, 1994). As for the study on the structure of vegetation community type, many scholars have performed studies like Lim & Kim(1992)' s 「Vegetation in Mt. Chiri」, Lee(1995)' 「A study on community classification of Abies koreana Forest and stand structure」, etc.

Mt. Daedun, in which we performed our study, is located on the border between southern temperature zones southern temperature zone and middle area middle area as we sees it in terms of vegetation belt of planting of trees(Uyeki, 1993), and it lies southern continent of the boundary between Chungnam and Chunbuk Province according to an administrative district.

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In this study, we will classify clusters by ZM method according to temperature, rainfall, forest soil, etc., which are vegetation' s correlational property, that is, species composition of living nature vegetation, and we are aiming to grasp the realities of inhabitat by the analysis of the relation with circumstances.

MATERIAL AND METHOD

1. General Condition on the Research Site.

Mt. Daedun is located between Kumsan-kun and Nonsan-kun of Chungnam province and Wanju-kun of Chungbuk province from 36° 5' to 36° 10' latitude and from 127° 16' to 127° 21' longitude.

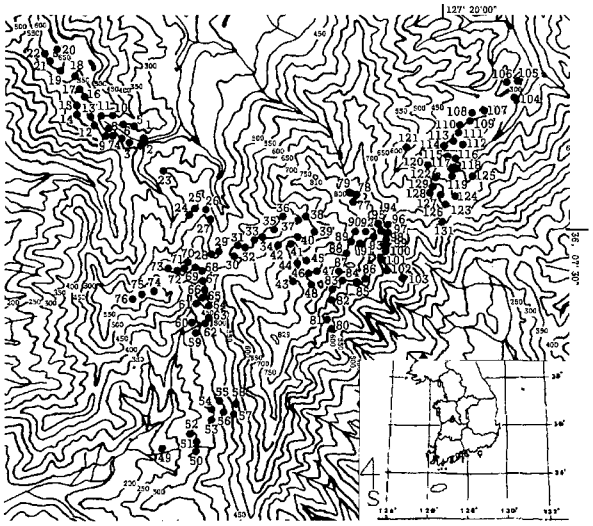
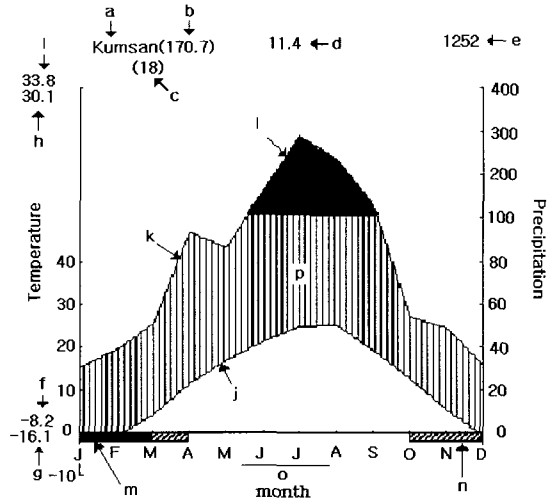


Fig. 1. Map showing the study sites in Mt. Daedun indicates plot numbers.

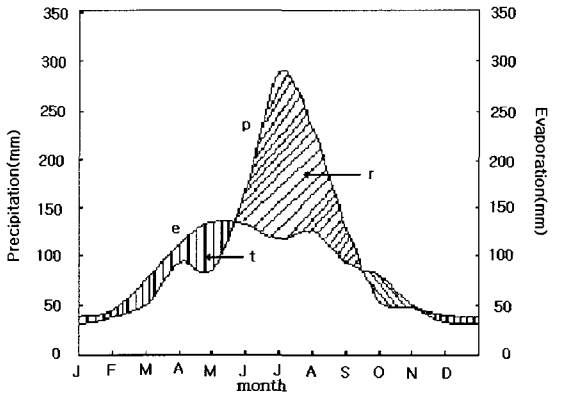
The climate of this site belongs to MSiMt inland mountains shape, and annual average temperature is around 18°. Annual temperature is chill and dry during January ~ March & October ~ December and excess rain fall-high temperature in June ~ August. It is reported that cool and heat, and the difference between day and night temperature are great(meteorology observatory, 1991).

Topography of the site is generally esteemed as very rugged and tough, and under-laying rock is shale. The geographical formation and ground is Majeon-ri stratum, Chang-ri stratum, Moonju-ri stratum, Oudae



a = Station ; b = Height above sea level(m)
c = Duration(years) of observasions ; d = Mean annual temperature(℃)
e = Mean annual precipitation(mm)
f = Mean daily minimum temperature of the coldest month
g = Lowest temperature recorded
h = Mean daily maximum temperature of the warmest month
i = Highest temperature recorded ; j = Curve of mean monthly temperature
k = Curve of mean monthly precipitation
l = Mean monthly rain>100mm(black scale reduced by 2/5)
m = Months with mean daily minimum temperature <0℃(black)
n = Late or early forests occur
o = Mean duration(days) of forest-free period ; p = Relative humid season

Fig. 2. Representative climate-diagram of Mt. Daedun.



p = Precipitation ; e = Evaporation
r = Water surplus ; t = Soil moisture utilization

Fig. 3. Water-balance diagram of Mt. Daedun.

Mountain quartzite layer, Seodae Mountain tuff, felsite, quartz-porphyry, etc. and lower area is mainly constituted of sedinentary rock(Hong & Choi, 1978).

2. Vegetation Investigation and Analysis

1) Vegetation Investigation

In order to analyze living forest vegetation around Mt. Daedun, we selected the homogeneous places of location condition or interrelation(Physionomy) and set up total 129 stations of 10 × 10m size quadrat.

Depending on Hong & Others(1987)' COLORED ILLUSTRATION OF TREE & SHRUBS IN KOREA and Lee' s(1989) ILLUSTRATED FLORA OF KOREA, we classified vegetation appeared in each quadrat, and also we estimated and noted each layer according to dominance value(7 classes) and sociability (5 classes) by the way of Braun-Blanquet(1964).

2) Vegetation Analysis

In Braun-Blanquet(1964)' s Tabula method which is phyto-sociological survey method, we analyzed the data which we got from the vegetation investigation of 129 stations by the way of a specific order that we follow to grasp the inter-species and inter-stand correlation, namely Tabulation technique of Z-M school(Braun-Blanquet, 1964; Ellenberg, 1956;Muller-Dombois and Ellenberg, 1974;Toyohara, etc., 1985).

We made up the synthesis table as a result figured out by signwark, and according to coincidence method of each vegetation units we examined the correlation with ground formation, see level height, DBH, tree height.

RESULT AND DISCUSSION

1. General View of Plant Type

As we see in Table 1, over pteridophyte tracheophytes is arranged to 117 family, 475 genus, 797 species, 102 variety, 18 breed, in total to 917 kinds. This corresponds to about 21.9% of our country' s tracheophytes 4191 kinds(Nakai, 1952), and as a data for the estimation of species diversity, Pteridophyte coefficient(PtPh - Q = B/A 25, B: Pteridophyte species number, A: Total emergence species) read as 0.66.

Table 1. The number of vascular plants in Mt. Daedun.

	Fam.	Gen.	Sp.	Var.	For.
Pteridophyta	6	12	16	1	0
Gymnospermae	5	12	22	2	0
Angiospermae	105	449	756	98	18
Dicotyledoneae	91	364	605	81	18
Monocotyledoneae	14	85	151	17	0
Total	116	473	794	101	18

When we see the diversity aspect of configuration in family, the number of classification clusters belonging to higher 11 family was 499 kinds and this occupies 48.9% in the whole. What shows the highest species diversity was Compositae family, and the next Rosaceae family and Gramineae family.

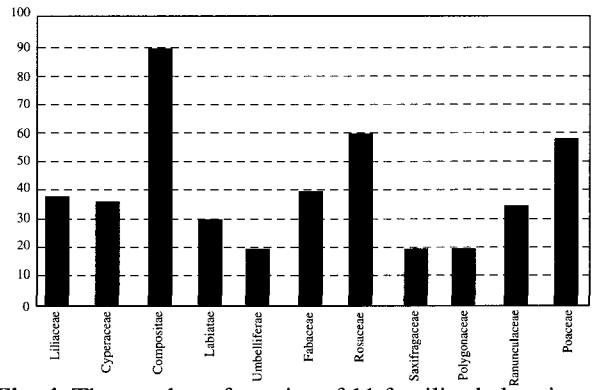


Fig. 4. The number of species of 11 families belonging to the higher level among total families taxa.

Most of the Research sites were almost national forest and all the areas were designated as natural forest park. The ground formation was rough, but forest was in good condition, so it is thought as maturity stage secondary forest that most areas represents middle areas' deciduous broad-leaved forest in our country.

2. Phyto-Sociological Classification.

We set up 129 investigation districts around Mt. Daedun forest and analyzed them by the Elledberg (1956)' s signwark with the data we got from the performance of vegetation research.

As our investigation' s object lies in classifying communities and understanding the ecological traits of each classified community, by the standard of dominant, indigenous species, feature species group, differential species group, differential, etc. we classify the highest units as community, the lower as group, and the lowest as sub-group. <Table 2> is the synthesis table on our research community, and we classified these as 12 groups and 2 sub-groups.

Table 2. Synthesis table of forest communities in Mt. Daedun.

I. Valley forests
- I-1 *Zalkova serrata-Acer mono* community
  - I-1-A *Acer pseudo-Lindera obtusiloba* group
  - I-1-B Typical group
  - I-1-C *Carpinus laxiflora-Styrax obassia* group

Ⅱ. Mountain forests
- Ⅱ-1 *Quercus mongolica-Rhodooendron schlippenbachii* community
  - Ⅱ-1-A *Fraxinus sieboldiana-Rhus trichocarpa* group
    - Ⅱ-1-A-1 *Quercus variabilis-Disporum smilacinum* subgroup
    - Ⅱ-1-A-2 Typical subgroup
  - Ⅱ-1-B *Vaccinium koreanum-Melampyrum roseum* var. *japonicum Franch group*
- Ⅱ-2 Quercus aliena-Styrax japonica community
  - Ⅱ-2-A Typical group
  - Ⅱ-2-B *Fraxinus mamdshurica-Aster scaber* group
- Ⅱ-3 Quercus dentata-Platycarya strobilacea community
- Ⅱ-4 *Quercus variabilis-Disporum smilacinum* community
  - Ⅱ-4-A Typical group
  - Ⅱ-4-B *Carpinus laxiflora-Styrax obassia* group

Ⅲ. Mixed Forest
- Ⅲ-1 *Pinus densiflora-Carex lanceolata* community
  - Ⅲ-1-A Quercus mongolica-Rhodooendron schlippenbachii group
  - Ⅲ-1-B Typical group
  - Ⅲ-1-C *Quercus serrata-Miscanthus sinensis* group

VEGETATION UNITS		Ⅰ			Ⅱ								Ⅲ		
		A	B	C	A			B		C	D		A	B	C
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Average altitude(m)		479	558	616	478	653	758	412	475	428	500	568	451	510	705
Direction		NE29	NE70	NE7	NW23	SE81	NE14	NW8	NE28	SW38	NE36	NE11	NE58	NW12	21
Average slope degree(°)		24	22	28	20	28	10	27	33	17	25	28	19	21	38
Topography		V-M	V-M	V-R	M-R	M-T	R		L-U	V-M	V-R	L-M	V-R	L-R	M-T
Survey area(m X m)		10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10
Average number of species		21	20	19	23	20	13	25	25	26	21	19	22	24	14
Average number of fild book		11	20	18	4	7	4	9	4	6	15	6	8	9	8
Trees(m/%)		12/50	15/60	16/61	12/70	9/51	7/48	15/58	14/70	10/50	18/67	17/62	9/45	10/53	6/38
Average D.B.H. of the largest trees(Cm)		27	28	31	20	17	16	30	21	17	30	30	23	22	22
subtrees(m/%)		6/21	7/21	8/26	6/20	5/23	3/		8/24	5/10	4/27	9/18	5/28	6/22	3/35
Bare rock(%)		52	34	18	0	19	3	9	40	10	14	3	8	10	54
Pinus densiflora Sieb. et Zucc.	T1	Ⅰ-1			Ⅳ1-2	Ⅰ-1		Ⅱ-1	Ⅱ-1	Ⅰ-1	Ⅰ-1		Ⅳ1-4	Ⅴ2-3	Ⅲ1-4
	T2			Ⅰ-1	Ⅱ-1			Ⅱ1-2	Ⅱ2-3	Ⅲ1-4					
	S		Ⅱ-1		Ⅱ-1										
1 *Carex lanceolata* Boott		Ⅲr-+	Ⅰr-1	Ⅳr-1	Ⅲ-+	Ⅲr-1	Ⅴr-1	Ⅲr-+	Ⅴr-+	Ⅴr-1	Ⅲr-+	Ⅲr-1	Ⅴr-1	Ⅳr-1	Ⅳ+-1
Carex humilis Leyss. var. *nana* (Lev, et Van' t.) Ohwi		Ⅱr-+	Ⅱr-1	Ⅲr-+	Ⅴr-1	Ⅳr-+	Ⅱ-+	Ⅲr-+	Ⅱ-r	Ⅳr-+	Ⅳr-1	Ⅱ-r	Ⅳr-+	Ⅳr-+	Ⅳ-+
Quercus serrata Thunb.	T1			Ⅰ1-3	Ⅱ-1		Ⅱ-2								Ⅱ-1
	T2		Ⅰ-1			Ⅰ-1					Ⅰ-1				Ⅳ1-2
	S		Ⅰ-1		Ⅱ-1	Ⅰ-1				Ⅱ-1			Ⅱ-1	Ⅱ-1	Ⅱ-1

Table 2. continued

Community Number		1	2	3	4	5	6	7	8	9	10	11	12	13	14
2 *Miscanthus sinensis* var. *purpurascens* Rendle					III r	II +			III r+	I +	I +			II r+	IV r+
Sedum polytrichoides Hemsl.						I r	II r							I +	III r+
Potentilla fragarioides var. *major* Max.					II r		II +			I r			I +	I +	II +1
Zalkova serrata Makino.	T1	IV 1-3	IV 1-3	III 1-3							I -1				
	T2	IV 1-3	III 1-4	II 1-2						I -1	I -2	I -1	I -1		
	S	I -1	I +1	I -1						I -1		I -1	II -1	I -1	
Acer mono Maxim.	T1	IV 1-4	III 1-3	III 1-3					II -3	I -1		I -3			
	T2	IV 1-2	II 1-2	II 1-2				II -1	III -1			II -2			3
	S	I +	I -1	II -1		I -1		I -1		I +	I -1				
Deutzia parviflora Bunge		IV r-1	III +-1	III +-2	II -1	I -2		III +-1	II -1	III r-1	I 1-2	II -1	I +	II +-1	
Fraxinus rhynchophylla Hance		IV +-4	II 1-3	I 1-2	II -1	I -1		III +-1		II 1-2	II 1-2	I -1	III -1	II -1	I -1
Hydrangea serrata for. *acuminata* (*Sieb. et Zucc.*) Wils		II +-1	II +-2	II +-2				I -1							
3 *Uonymus macropterus* Miq.		I -1	II 1-2	I -1											
Euonumus pauciflorus Maxim.		II +-1	II 1-2	II -1				I -1			I -1	II 1-2			
Conus controversa Hemsl		I -1	III 1-4	II 1-2		I -2		II 1-2		II -1	I 1-2		I -1	II -2	
Lindera erythrocarpa Makino		IV +-2	III 1-3	III +-2	II -1			III +-1	III 1-2	III +-1	II -1	IV +-1	II 1-2	II -1	
Sasa borealis(Hack.) Makino		II 1-3	IV 1-3	III 1-4		II -1	IV 2-4	II 1-4	III 1-4		I r-3	I -4	II 2-4		
Quercus mongolica Fisch	T1	II 1-2	II 1-4	II 1-3	V 2-4	V 2-4	V 3-4			I -1	II 1-2	III -1	II 1-2		II 1-2
	T2	III 1-3		I -1	IV 1-3	III 1-3	IV -1	I -2		I -1	IV 1-2		V 1-2		II 1-2
	S				II -1	III -1				I -1	I -1		III -1		I -1
4 *Rhodooendron schlippenbachii* Maxim.				I +1	IV 1-2	V 1-2	V 2-3		II -1		I -1		II -1	I -1	III 1-2
Rhodooendron mucromyatum Turcz			I -1	I +1	IV 1-2	III +-2	V +-3			II 1-2	I +-2	II -+	II 1-2	II -1	IV 1-3
Fraxinus sieboldiana Bl.			I -1	I 1-2	V 1-2	V 1-2	II -1	II +-1	II -r	II -1	II +-2	I -+	III r-1	II 1-2	V +-2
Rhus trichocarpa Miq.				I -1	V -1	V +-1		III +-1		II -1	II +-1		III -1	III 1-2	II -1
5 *Lespedeza bicolor* Turcz.				I -+	IV -1	IV +-1		I -+	II -+		II 1-2	I -1	I -1	III -1	IV +-1
Quercus variabilis Bl.	T1	II 1-2	I -1	II 1-2	IV 1-2	I -1		IV 1-2			V 1-4	V 2-4	III 1-2	III -1	II 1-2
	T2			I -2	II -1			II -1		II 1-2	II 1-2		II 1-2	I -2	I -1
	S				II -1								II -1	I -1	
6 *Disporum smilacinum* A. Gray		II r-2		II r-+	IV r-+	III -r	II -+	II +-1	II -r	IV r-+	III r-+	V -r	II r-+	III -r	
Lysimachia barystachys Bunge			I -r	I -r	IV -r	III -r		II -r		I -r	III -r	II -r	I -r	III -r	
Viola dissecta Ledeb. Var. *chaerophylloides(Regel)* Makino		II -r	I -r	II -r	II -r			III r-+	II -r	II -r	III r-+	II -r	II r-+	II -r	
Hemerocallis fulva L.					III -r	I -r	II -r	I -r		I -r	II r-+		I -+	II r-+	II r-+
Quercus aliena Blume	T1	I -1	I 1-2	II 1-2				V 2-3	V 1-4	III 1-2	II 1-2	II -1	I -2	II 1-3	
	T2							III 1-2	III -1				I -1	II -2	
	S							II +-1		I -1					
7 *Styrax japonica* Sieb. et Zucc.		III 1-2	I 1-2	I 1-2	III -1			V 1-4	III -2	III 1-3	I 1-2	I -2	III 1-2	II -2	
Prunus sargentii Render		II -1	II -1	II 1-2		IV +-1		IV 1-4	V 1-3	III -1	II -1	I -1	III 1-2	III -1	II -1
Carpinus laxiflora(Sieb. Et Zucc.) Blume	T1	I -2	I -1	V 1-4		I -1	II -2	III 1-2	III 1-2		I -2	V 1-2	II 1-3	I -1	I -1
8	T2			III 1-2		II 1-2	II -1	II -1	II -1		I 1-2	V 1-2	I -2	I -1	
	S			II 1-2	II -1			I -1			I 1-2	II -1			I -1
Styrax obassia S. et Z.		II 1-2	III 1-2	IV 1-2	V -1	I -1	II -2	III 1-2	IV +-2	II -1	II 1-2	V 1-2	II 1-2	II -1	II -1
Quercus dentata Thunb.	T1		I -2							III 1-3	I -1		I -2	I -2	
	T2			I -1						V 1-2	I -1	I -1	II -1	I -1	9
	S		I -1							I -+		I -1		II 1-2	
9 *Platycarya strobilacea* Sieb. et Zucc.	T1	I -1	I -1	I -2				II -1		IV 1-3	I -1	II 1-2		II -1	
	T2									III 1-2		I -1			
	S									II -1				II -1	
Acer pseudo-sieboldianum Kom		V r-2	I -1	II 1-3	II -1	III 1-2	II -1	IV +-2	II -+	IV +-2	II 1-2	II -1	II -1	II -1	I -2
10 *Lindera obtusiloba* Blume		V +-1	III +-2	II +-2		II -1	II -1	III r-1	III 1-2	I -1	IV +-2	V 1-2	III -1	II r-1	I -1
Vaccinium koreanum Nakai					III -1	II -1	IV +-1				I -1				II +-1
11 *Melampyrum roseum* var. *japonicum Franch.* et Savat			I -r	I r-+	II -+	I -r	V -r		II -+	II -+	I r-+		III r-+		II -r
Fraxinus mamdshurica Rupr.		I -3	I -2	I -1				I -2	V -1					I -1	
12 *Aster scaber* Thunb.					II -r	III -r		I -r	V -r	I -r		I -r	II r-+	II -r	
Ligularia fischerii(Ledeb.) Turcz.									IV r-+						
Oplismenus undulatifolius (ard.) Roem. et Schult		IV r-+	II r-1	III r-1				II r-+	V r-+	I -r	III r-+	IV r-+	II -r	III r-+	I -+
Athyrium yokoscense(Fr. et Sav.) H. Chirst		III r-+	III r-1	IV r-+	II -r	II r-1		III r-+	II -1	I -+	I -r	II -r	II -+	II -r	
Polugonatum odoratum(Miller) Druce var. *Pluriflorum(Miquel) Ohwi*		I -r	I -r	II r-+		III -r	IV -r	III r-+	IV -r	III -r	II -r	III r-+	III r-+	II r-+	II -r
Magnolia Magnolia sieboldii K. Koch		III +-2	II +-1	I -1		II -1	IV +-1	III +-1	II -1	II 1-2	I -1	I -1	II -1	I -1	II 1-2

Table 2. continued

Community Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Symplocos chinensis for. Pilosa (Nakai) Ohwi	I -+	I -1	II +-1	II -1	III +-1	II -1	III +-1	II -+	II 1-2	II r-1	III -1	II +-1	II -1	
Stephanandra incisa Zabel	II +-1	II +-1	I -+	II -1	II +-1		II r-1		II +-1	III -1	I -+	II -1	III 1-2	
Vidla selkirkii Punsh	I -r	I r-+	I r-+		III -r		III -r	II -r	I -+	II -r		II -r	II r-+	
Viola acuminata Ledebour	III -r	II r-+	I -r	III -r			II r-+		I -r	II -r		I -r	I -r	
Lespedeza maximowiczii Schneid	I +-1	I -+	I +-1		I -+		III +-1	II -1	I -1	II +-2	II -1	II +-1	II -1	
Smilax china L.	I -+		I -+	III -r			III r-1	IV r-+	III r-1	I -r	I -1	I -+	II r-1	I -+
Scutellaria indica L.	II -r	II r-+	I -r		I -r		II -r		II -r	II r-2		I -r	II -r	
Ainsliama acerifolia Sch.-Bip.	I -+	I r-+	I -r		I -1		II -r	III -r		I r-1	II r-1	II -r	I -+	
Zanthoxylum schinifolium Sieb. et Zucc.	I -1	I -1	I -1	II -+	III +-1		II 1-3	II -1	II -1	II +-1				II -1
Callicarpa japonica Thunb.	I -1	I 1-2	I -1		I -1		I -1	III -1		II +-1	II +-1	I -1	II -1	
Pteridum aquilinum var.latiusculum (Desv.) Underw			IV r-+	I -+	II -r	I -r	II -r	II r-+	I r-2	I -r	II -r	I -r	II -r	
Artemisia stolonifern(max.) Komarov		I -r	I -r	II -r		II -r	III -r	II -1	II r-+	I -+		I -+	I -r	I -r
Lindera glauca Blume			II +-1		II -1		II +-1	III r-2	I -1	I +-1	I -+		II +-1	I -2
Sorbus allnifolia(Sieb. et Zucc.) K. Koh		I -1	I -1	II -1	II 2-3	III -1	II -2	II -1		I -1		II -1		
Saussurea seoulensis Nakai		I -r		II -r	II -r	II -r	II r-+			I -r	I -r	I -r	II -r	
Thalictrum aquilegifolium L.	II -r	I -r						II -r	I -r	I -r	I -r	I -r	II -r	
Carex siderostica Hance	I -r			II -+	III r-1		II -r		I -r	I -r	I -r	II r-+	I -r	
Msmilax riparia A. DC. var. ussuriensis Hara et T. Koyama	I -r				II -r		II r-+		II -r	I -r		II -r	II -r	
Staphylea bumalda Dc.	II -+	I -1			I -2		II +-1	II -1	II -1			I -1	II -1	
Catalpa ovata G. Don	II -r	I -r	II r-+				I -+	II -r		I -+	I -r		I -+	
Asarum sieboldii Miquel	I -r	I -r	I -+				I -r		I -+	II r-+		II -r	II r-+	
Actaea asiatica Hara		I -r	I -r		II -r		II r-+					I -r		
Pyrola japonica Klenze			I -r	III -r			I -r	II -r	I -r	I -r	I -r	I -r		
Philadelphus schrenckii Ruprecht var. jackii Koehne	I -+	I +-1	I -1		II +-1			II -1		I -1		I -1	I -1	
Parthenocissus tricuspidata (Sieb. et Zucc.) Planch.	II r-+	I -r						II -1	II r-1		I -1		I -+	
Viola mandshurica W. Becker	I -r	I -r	II r-+	II -r						I -r				
Vidla variegata Fisch	II r-+	I -r	I -r				I -r		II -r	I -r	I -r		I -r	
Rubus parvifolius L.		I -+	I -+		I -1				I -+	I +-1	I -1		II +-1	
Indigofera kirilowii Maxim.	I -r	I -+							II r-1	I -r		II r-+	II r-1	
Convallaria keiskei Miq.	I -r	I -r					II -r		II -r			II -r	I -r	
Euonumus alatus(Thunb.) Sieb.	II +-1		I -1		I -+		I -+		II +-1		I -1		I -1	
Corylus heterophylla var. thunbergii Bl.	I -+	I -1					II +-1	II -r	I -+	I -1			I -1	
Maackia amurensis	I -1	I -1			I -+			II -1		I -1			I -1	
Ligustrum obtusifolium Sieb. et Zucc.	I -+	I -1	I r-+				I -+	II -r	II -1					
Scutellaria pekinensis var. transitra		II r-+	I -r											
Morus bombysis Koidz.		I -1	I -1					II -1	II -1	I 1-2				
Sambucus williamsii Hance var.coreana	I -+	I +-1	I +-1				I -1		I -1	I -1				
Weigela subsessilis Bailey		I r-1	I r-1		I -1				II +-2		I -r			
Lespedeza pilosa(Thunb.) S. et Z.	I -+	I +-1					I -+			I -+			II -1	
Asparagus achoperioides Kunth	I -r	I -r						II -r		I -r			II -r	
Syneilesis palmata(Thunb.) Maxim.	I -+		I -r							I r-+	I -r		I -+	
Agrimonia pilosa Ledeb.	I -r	I -r			I -1		I -r			I -r			I -r	
Arisaema amurense var.serratum Nakai.	I -r	I r-+			I -r		I -r				I -r			
Celtis sinensis Pers. var. japonica	I -1	I 1-3						II -2					I -1	
Actinidia arguta(S. et Z.) Planchon	I -1	II +-1						II -2						
Torilis japonica(Houttuyn) DC.		I -r	I r-+					III -r	I -r					
Rubia akane Nakai		I -r	I -r					II -r				I -r		
Melampyrum roseum			I -+	II -r	I -+		I -r				I -+	I -r		I -r
Solidago virga-aurea L. var. asiatica Nakai		I -r	I -r							I -r			II -r	
Smilax siebolii var. inermis		I -r	I r-+				I -r				I -+	I -r	I -r	
Peucedanum terbinthaceum Fisch.	II r-+	I -r							I -+			I -r	I -r	
Philadelphus schrenckii Rupr.	I -1	I -1	I -1				I -2			I -+			I -1	
Deutzia prunifolia Render		I -1	I -1				I -1				I -1			
Corylus hallaisanensis Nakai	II +-1	I +-1												
Cephalanthera longibracteata Blume		I -r	I -r				I -r				I -r		II -r	
Vicia unijuga A. Braun	I r-+							II -+	I -r			I -r	I -r	
Dioscorea septemloba Thunb.	I -r		I -r						I -+	I -r	I -r		I -r	
Cocculus trilobus(Thunb.) De Candolle	I -r		I -r				II -r						I -+	
Pyrus calleryana var. fauriei (Schneid.) Rehder	I -+									I -1	II +-1		I -1	
Cormus kousa Buerg.	I -1	I -2	I -1											
Carpesium abrotanoides L.		I -r					I -r	II -r					II -r	

Table 2. continued

Community Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Akebia quinata(Thunberg) Decaisne		I -r	I r-+									I -+	I -+	
Eupatorium chinense var. simplicifolium				II -r						I -r	I -r		I -r	
Zanthoxylum piperitum A. P. Dc.		I -1	I -1					II -1				I -1		
Codonopsis lanceolata (Seib. et Zucc.)Trautv.	I -r			I -r		I -+	II -r			I -r				
Betula *devurica Pallas*		I -2	I -3						I -2					I -1
Arisaema heterophyllum Blume	I -r		I -r		I -r		I -r	II -r						
Disporum sessile D. Don.	I -r						II -r		I -r				I -r	
Pinellia ternata(Thunb.) Breitenbach	I -r		I -r				I -r		I -r					
Cryptotaenia japonica Hassk.	I -r		I -r							I -r		I -+		
Ambrosia japonica Thunb							I -r		I -r	I -r			I -r	
Aquilegia buergeriana var. oxysepal	I -r	I r-+							I -+					
Pyrus udduriensis Max.									I -1			I -1	II -1	
Ampelopsis brevipedunculata (Max.) Trautv.				II -r	I -1		I -1				I -r			
Impatiens textori Miq.			I -r							I -+			II -r	
Albizzia julibrissin Durazz.		I -1						II -1				I -1	I -1	
Vites coignetiae Pulliat	I -1	I -+								I +-1				
Arthraxon hispidus Makino		I -r	I -r		I -r				I -r					
Dioscorea batatas Decne							I -r		II -r	I -r				
Vicia amoena Fischer		I -r					I -r		I -r	I -r				
Iris rossi Backer							I -r			I -r		I -r	I -r	
Sapium japonicum Pax. et Hoffm						II -1						I -1		I -1
Atractylodes japonica				II -r						I -r		I -+		
Melica onoei Franchet													II -1	I -+
Artemisia plinceps var. orientalis			I r-+		I -r									
Arundinella hirta C. Tanaka	I -r						I -+	I -+						
Commelina communis L.		I -r	I r-+											
Clematis mandshurica Max.	I -r	I -+											I -r	
Astilbe chinensis var. davidii				II -r					I -r			I -r		
Melica onoei		I -r			I -+									I -+
Dictamnus dasucarpus Tura										I -r				
Sanguisorba officinalis									I -r	I -r			I -r	
Primula sieboldii E. Morr.		I -r							II r-+					
Saussurea maximowiczii Herder						II -r	I -r					I -r		
Aralia elata(Miq.) Seemann			I -+				I -1							
Melampyrum roseum										I -r			I -r	
Ixeris sonchifolia Hance		I -r	I -r											
Carex okamotoi Ohwi					I -r							I -r		

Note : T(top), R(ridge), U(upper part of slope), M(middle part of slope)
L(lower part of slope), V(valley)

These communities are roughly classified as species group 3' s *Zelkova serrata*(Thunb.) Makino, *Acer mono* Maximowicz and valley lignosa which is divided by *Sasa borealis*(Hack.) Makino, *Euonymus alatus* for. *ciliato* dentatus Hiyama, *Hydrangea serrata* for. *acuminata*(S. et Z.) Wilson, etc. of lower-layer vegetation, and species group 4' s *Quercus mongolica* Ficher, *Quercus variabilis* Blume, *Quercus aliena* Blume, *Carpinus laxiflora* Blume, *Qurecus dentata* Thund. and mountain area lignosa which is divided by *Ligularia fischerii*(Ledeb.) Turcz., *Aster scaber* Thunb., *Melampyrum roseum* var. *japonicum* Franch. et Savat., etc. of lower-layer vegetation, and species group 1' s *Pinus densiflora* Siebold et Zuccarini, *Quercus serrata* Thunberg and mixed forest which is divided by *Miscanthus sinensis* Anderss, *Sedum polystichoides* Hemsl., *Potentilla fragarioides* var. *major* Maxium., *Carex lanceolata* Boott, etc. of lower-layer vegetation.

1. Valley Forest

1-1 *Zalkova serrata-Acer mono* community

As species group 3 is the community apeared as feature species group which is consisted of *Zelkova serrata*(Thunb.) Makino, *Acer mono* Maximowicz, *Fraxinus rhynchophylla* Hance, *Deutzia parviflora* Bunge, *Hydrangea serrata* for. acuminata(S. et Z.)

Wilson, etc., it is classified into three lower unit groups by the lower discrimination defferential species group 8 and 10.

When we survey each layer' s species composition of communities, though it differed a little according to location circumstances, tree layer were dominated by *Zelkova serrata*(Thunb.) Makino, *Acer mono* Maximowicz, etc. and mixed with *Cornus controversa* Hemsley, etc., and in the lower part of subtree layers there were mainly distributed with *Fraxinus rhynchophylla* Hance, *Lindera erythrocarpa* Makino, *Euonymus macropterus* Rupr., *Euonymus alatus* for. *ciliato-dentatus* Hiyama, *Deutzia parviflora* Bunge, *Hydrangea serrata* for. *acuminata*(S. et Z.) Wilson, etc. and in some parts there being distributed with *Sasa borealis*(Hack.) Makino consisting a community.

The location surroundings of a community was 22~28% of slope, percentage of rock outcrop 18~52%, and moisture condition of soil was damp.

The research districts used in community classification were 49 stations, average appeared species number per research district 20 species, maximum tree average breast height diameter 27~31cm, and average percentage of vegetation cover showed as 50~61%.

Quercus mongolica Ficher, *Quercus variabilis* Blume was found a few in tree layer, but, as a result we reached from the research for potential dominance of a community through the occurrence and remaining of tree seedling and young tree, oak, etc., which we consider them as suntree forest(Kim, 1993), were hardly found. *Zelkova serrata*(Thunb.) Makino, *Acer mono* Maximowicz, *Carpinus laxiflora* Blume, etc., which being the tree-specie classified as climax tree species(Kim, 1993), were dominating from canopy to young tree, seedling. So far as there happened no particular disturbance, it is thought that this community will lead to lockout forest type of climax forest condition as we could see in the studies of Choi & Park(1985), and Kim & Kim(1988).

1-1-A. *Acer pseudo-Lindera obtusiloba* Group

In species group 10, *Acer palmatum* Thunb. appeared as a distinct differential species group. Species group 10 was the sub-unit of species group 3.

When we saw each layer' s species composition of a community, tree layer showed as constance class(Ⅳ) where *Acer mono* Maximowicz were highly distributed, and mixed a few with *Quercus mongolica* Ficher, *Quercus variabilis* Blume, *Carpinus laxiflora* Blume, but in the lower subtree layer there appeared many of *Acer mono* Maximowicz, *Zelkova serrata*(Thunb.) Makino young tree · seedling. Especially, as a differential species group *Acer palmatum* Thunb., *Lindera obtusiloba* Bl. appeared as constance class Ⅴ.

1-1-B. Typical Group

This community is discriminated from 1-1-A and 1-1-C as this has species group 3 and had not lower species group below species group 4.

When we investigated the vegetation formation by each layer species composition of communities, *Acer mono* Maximowicz, *Cornus controversa* Hemsley, etc. were highly dominating in upper story which formed the higher-layer *Zelkova serrata*(Thunb.) Makino, and a few Oak were mixed in it, but there were no occurrence of young tree, seedling in Oak. But we could observe a lot of occurrence in the young tree, seedling of *Zelkova serrata*(Thunb.) Makino, *Acer mono* Maximowicz, *Cornus controversa* Hemsley which they were the strong shade tolerance tree species(Kim, 1993).

1-1-C. *Carpinus laxiflora-Styrax obassia* Group

In species group 8 *Carpinus laxiflora* Blume appeared as highly distinctive specie community. Species group 8 was a lower unit community of species group 3.

When we checked the species composition per layer-

level of this community, *Carpinus laxiflora* Blume was dominating as constance class in upper story, and there appeared *Zelkova serrata*(Thunb.) Makino, *Acer mono* Maximowicz and a few Oak. In subtree layer, there were *Carpinus laxiflora* Blume, *Zelkova serrata* (Thunb.) Makino, *Acer mono* Maximowicz, and a few Oak. In lower-layer there appeared a lot of *Carpinus laxiflora* Blume, *Zelkova serrata*(Thunb.) Makino young tree in addition to *Euonymus alatus* for. *ciliato dentatus* Hiyama, Sasa borealis(Hack.) Makino, etc., but there appeared no other trees tree species like Oak, etc.

Ⅱ. Mountain Forest

Ⅱ-1. *Quercus mongolica-Rhodooendron schlippenbachii* Community

This community was discriminated by the feature species group like *Quercus mongolica* Ficher, *Rhododendron schlippenbachii* Maximowicz of species group 4 and was distributed from middle mountain slope around sea height 400~800m to the neighborhood of the peak, and also this was classified as *Fraxinus sieboldiana* Bl. community, Vaccinium koreanum Nakai community, and again *Fraxinus sieboldiana* Bl. community classified to *Quercus variabilis* Blume community and typical sub-group.

When we researched the each layer-level' s species composition of a community, though it differed a little according to location surroundings, *Quercus mongolica* Ficher were dominating in upper story, and in the lower of subtree layer, *Rhododendron schlippenbachii* Maximowicz, and *Rhododendron mucronulatum* Turcz., etc. were mainly distributed. As the altitude develops, the appeared species decreased.

Kim(1992) divided it into *Rhododendron schlippenbachii* Maximowicz-*Quercus mongolica* Ficher community, and again divided it in the lower units by typical sub-community and *Sasa borealis*(Hack.) Makino sub-community, and then said it is located in the lower part of altitude 1000m, but, though the altitude differed a little according to research area, in common the report which says *Quercus mongolica* Ficher community was distributed forms from the middle-higher mountain slope to the ridgeline part corresponds to our research sites.

Ⅱ-2. *Quercus aliena* Community

Species group 7 was a community classified by distinctive species community of *Quercus aliena* Blume, *Styrax japonica* Sieb. et Zucc., etc. and was distributed in valley and middle-lower mountain slope around sea height 310~800m. By the terms of existence or non-existence of species group 12 like *Fraxinus mandshurica* Rupr., *Aster scaber* Thunb., *Ligularia fischerii*(Ledeb.) Turcz., etc., it was classified into lower unit of two groups.

The location circumstances of communities was 27~33% of average slope and percentage of rock outcrop was 9~40%. The research districts used in classifying communities were 13, and the number of the average appeared species per each research site was 25 ones. The average breast height diameter of upper story was 21~30cm, average tree height 14~15m, and percentage of vegetation cover showed 58~70%. The average tree height of subtree layer was 5~8cm, and percentage of vegetation cover was Shown as 10~24%.

In the research of Lee & Others(1988) and Kim (1993), *Quercus aliena* Blume was a lower shade tolerance sun tree and, as like *Quercus variabilis* Blume community in Cho(1990), a community which was developed into the secondary forest after the original vegetation was destroyed. And also they said that it was distributed in fertile soil of the middle slope of altitude 420~480m and underwent severe competition among Oak. *Quercus aliena* Blume community of our research site was distributed in the topography similar to this, that is, from higher area of valley to mountain slope, so it is thought as a seral stage community where exists

severe competition as various trees tree species mingled with.

Ⅱ-3. *Quercus dentata-Platycarya srrobilacea* Community

This was a community discriminated by the distinctive species community like *Qurecus dentata* Thund., *Ligularia fischerii*(Ledeb.) Turcz., etc. of species group 9 and was distributed in the ridgeline of average altitude 428m.

The location circumstances were 17 % of average slope, average percentage of rock outcrop 10%, and direction was SW38. The number of research districts used in classifying communities was 6 and the number of average appeared species was 26. The each layer-level community structure was 10m of average tree height of upper story, average breast height diameter 17cm, average percentage of vegetation cover 50%, and the average tree height of subtree layer was 4m and average percentage of vegetation cover showed 27%.

As this community, which is studied by Kim(1993), was the low shade tolerance exponent, sun tree, *Qurecus dentata* Thund.-*Ligularia fischerii*(Ledeb.) Turcz. was forming upper story and percentage of vegetation cover was lower than other communities. In subtree layer there appeared *Qurecus dentata* Thund., *Ligularia fischerii*(Ledeb.) Turcz., *Acer palmatum* Thunb., *Prunus sargentii* Blume, *Styrax japonica* Sieb. et Zucc., etc. and percentage of vegetation cover was higher than other communities, and the shrub layer development was weak. In herb layer there found various species as like Melampyrum roseum var. japonicum Franch. et Savat., *Carex humilis* Leyss, *Carex lanceolata* Boott, *Polygonatum oboratum* var. *pluriflorum* Ohwi, *Scutellaria indica* L., *Disporum smilacinum* A. Gray, etc.

According to Matgalef(1963), species diversity was seen in the first or middle succession stage. As the species were more diverse in the subtree layer than in upper story in our research, it is thought that this is a community formed to secondary forest.

Ⅱ-4 *Quercus variabilis* Community

This was a community classified by the specific species community as like *Quercus variabilis* Blume, *Disporum smilacinum* A. Gray, etc. of species group 6 and was distributed in the middle-lower mountain slope around altitude 350~700m. According to the existence or non-existence of distinctive species community of *Styrax obassia* Sieb. et Zucc., this was divided into two lowe unit groups.

The location circumstances of communities was 25~28% of average slope, average percentage of rock outcrop 3~14%. The research districts used in classifying communities was 21 sites, the number of average appeared species was 21, and maximum tree breast height diameter was 30cm. *Quercus variabilis* Blume community was the one developed to secondary forest after other vegetation was destroyed(Kim 1987), it is said that this was distributed in the slope and ridgeline of altitude 700~900m in Mt. Dukyu(Kim, 1991) and in the slope of altitude 400~700m in Mt. Sukri(Kang & Lee, 1992). This means that the result has a lot of similarities to our research.

Ⅲ. Mixed Forest

Ⅲ-1. *Finus densiflora-Carex lanceolata* Community

This community was classified into the distinctive species community like *Pinus densiflora* Siebold et Zuccarini, *Carex humilis* Leyss, *Carex lanceolata* Boott of species group 1, and its vertical distribution range was average altitude 300~880m. This appeared mainly in the peak and a few in the mountain slope. Average slope was 19~38° and average percentage of rock outcrop was around 8~54%.

The research districts used in classifying communities were 25 sites and there appeared average 19 species per research site. The structure of each layer-

level communities by species composition was average 6~10m and average breast height diameter 22~23cm in upper story, and tree height 3~5m and percentage of vegetation cover was 22~35% in subtree layer

This community was classified into three final lower units by the Quercus serrata Thunberg community of lower-level species group 2, *Quercus mongolica* Ficher, *Rhododendron schlippenbachii* Maximowicz of species group 4, and typical community.

Pinus densiflora Siebold et Zuccarini was distributed in the foot of the mountain where were affected a lot by the human activities, but this distribution was various as it was consisted of natural forest in the mountain ridge and rock outcrop, etc. and formed locational climax forest(Lim & Kim, 1992).

Ⅲ-1-A. *Quercus mongolica* Group

Species group 4 was classified by distinctive species communities like *Quercus mongolica* Ficher, *Rhododendron schlippenbachii* Maximowicz, etc. and was the lower unit of species group 1.

When we observe the each layer-level species composition of communities in upper story, Pinus densiflora Siebold et Zuccarini was dominating and *Quercus mongolica* Ficher and *Quercus variabilis* Blume was mingled in it. In subtree layer *Quercus mongolica* Ficher was highly dominating and there appeared Pinus densiflora Siebold et Zuccarini, *Quercus variabilis* Blume, *Prunus sargentii* Blume, *Styrax japonica* Sieb. et Zucc., *Acer palmatum* Thunb., *Lindera obtusiloba* Bl., etc. In shrub layer, there were Lindera erythrocarpa Makino, *Sasa borealis*(Hack.) Makino, *Fraxinus rhynchophylla* Hance, *Fraxinus sieboldiana* Bl., *Symplocos chinensis* for. *pilosa*(Nakai) Ohwi, etc. , and there showed *Aster scaber* Thunb., Disporum smilacinum A. Gray, Lysimachia barystachys Bunge, *Carex lanceolata* Boott, *Carex humilis Leyss*, *Melampyrum roseum* var. *japonicum* Franch. et Savat., *Polygonatum oboratum* var. *pluriflorum* Ohwi, etc. in herb layer.

Ⅲ-1-B. Typical Ground

As this community has distinctive species community 1 and doesn' t have lower species communities of species group 2 and species group 4, it differs from Ⅲ-1-A, Ⅲ-1-C.

When we investigated the each layer-level of communities, there formed of pure forest with *Pinus densiflora* Siebold et Zuccarini and mixed with a few *Quercus variabilis* Blume in upper story, and there appeared *Pinus densiflora* Siebold et Zuccarini, *Cornus controversa* Hemsley, *Lindera erythrocarpa* Makino, *Styrax japonica* Sieb. et Zucc., *Prunus sargentii* Blume, etc. in subtree layer, *Rhododendron mucronulatum* Turcz., *Rhododendron schlippenbachii* Maximowicz, Stephanandra incisa Zabel, *Symplocos chinensis* for. *pilosa*(Nakai) Ohwi, etc. in shrub layer, and *Viola mandshurica* W. Becker, *Lysimachia barystachys* Bunge, *Carex humilis* Leyss, *Carex lanceolata* Boott, etc. in herb layer.

Ⅲ-1-C. *Qiercis serrata* Group

Species group 2 showed *Quercus serrata* Thunberg as a strong distinctive species community and was a lower unit of species group 1.

When we observe the each layer-level species composition of communities, *Pinus densiflora* Siebold et Zuccarini, *Quercus serrata* Thunberg, *Quercus mongolica* Ficher, etc. were consisting of upper story and the sea height was lower in comparison with the breast height diameter and percentage of vegetation cover was low subtree layer was dominated by *Pinus densiflora* Siebold et Zuccarini, *Quercus serrata* Thunberg, *Rhus trichocarpa* Stokes, *Fraxinus sieboldiana* Bl. and showed the characteristic of high percentage of vegetation cover. There appeared *Lespedeza bicolor* Turcz., *Rhododendron mucronulatum* Turcz., etc. in shrub layer and *Miscanthus*

sinensis Anderss, *Carex lanceolata* Boott, *Carex humilis* Leyss, *Melampyrum roseum* var. *japonicum* Franch. et Savat., *Potentilla fragarioides* var. *major* Maxium., *Sedum polystichoides* Hemsl., etc. in herb layer, but forest condition was poor.

3. The Relationship between Vegetation Unit by Coincidence Method and Correlational Factors of Topography, Sea height, etc.

In order to verify ecological traits per each vegetation unit and the rules of community distribution in the Synthesis table, we examined the correlation between the vegetation unit classified according to community and vegetation correlational factors of topography, sea height, etc.(Suzuki & others, 1997).

Figure 5 shows the correlation between vegetation unit obtained from the community classification and topography. There formed *Zelkova serrata*(Thunb.) Makino-*Acer mono* Maximowicz community in the valley and *Quercus mongolica* Ficher community in mountain slope, and *Quercus aliena* Blume, *Qurecus dentata* Thund., *Quercus variabilis* Blume communities, which were forming secondary forest(Lee & others, 1996), were constituted in the middle-lower mountain slope where was easy to be affected by human' s interference. *Quercus mongolica* Ficher community, as it is the lower unit of *Pinus densiflora* Siebold et Zuccarini community which is mixed forest, was distributed in the ridgeline, and typical group was from the middle mountain slope to ridgeline, and *Quercus serrata* Thunberg community was largely in the ridgeline. What was formed affected by the influence of topography(Odum, 1969) was coincident to the community distribution in Mt. Sukri of Kang & Lee(1990).

Figure 6 shows the correlation between community-classified vegetation units and sea height. When we observed the lower unit community of valley forest, *Zelkova serrata*(Thunb.) Makino-*Acer mono* Maximowicz community, there were distributed *Acer palmatum* Thunb.-*Lindera obtusiloba* Bl. community in the lower valley where was the valley entrance of low altitude, *Zelkova serrata*(Thunb.) Makino-*Acer mono* Maximowicz typical group in middle valley, *Carpinus*

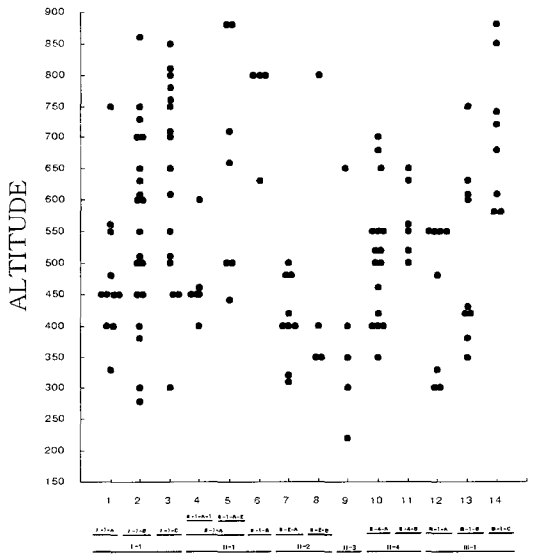


Fig. 5. Relationships between vegetation units and altitude

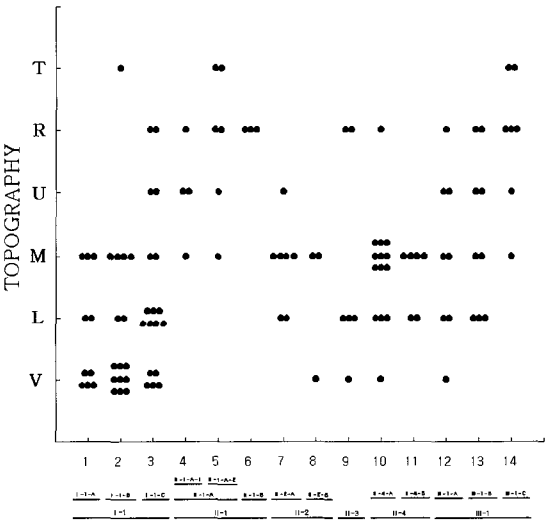


Fig. 6. Relationships between vegetation units and topography

laxiflora Blume-Styrax obassia Sieb. et Zucc.Styrax obassia Sieb. et Zucc. group in the upper valley. *Quercus mongolica* Ficher community, which was mountain forest, being distributed in the high altitude, and *Quercus aliena* Blume, *Qurecus dentata* Thund., *Quercus variabilis* Blume communities, which were seral stage as a secondary forest, were distributed in the low altitude. *Quercus mongolica* Ficher community, which was the mixed forest and the lower unit of *Pinus densiflora* Siebold et Zuccarini community, was in the low altitude, typical group in the middle, and *Quercus serrata* Thunberg community was located, distributed and formed in the high-altitude place. This shows similar community distribution type to the study of Mt. Sukri(Kang & Lee, 1990) and Mt. Baekhwa(Cho & others, 1991) where they were in the similar latitude to our research areas.

If we see the present vegetation in Mt. Daedun in synthesis of those results, it showed that there was dominated and distributed by *Zelkova serrata*(Thunb.) Makino and *Acer mono* Maximowicz in valley forest, Oak forest in mountain slope, *Pinus densiflora* Siebold et Zuccarini forest in mountain ridge. Valley forest was dominated by *Zelkova serrata*(Thunb.) Makino and *Pinus densiflora* Siebold et Zuccarini communities which were high in shade tolerance(Kim, 1993), and in the low altitude there were formed by *Zelkova serrata*(Thunb.) Makino-*Acer mono* Maximowicz communities, and it showed there were formed with *Carpinus laxiflora* Blume community in the high altitude. Oak was consisting of main specie in mountain forest and *Quercus variabilis* Blume, *Qurecus dentata* Thund., *Quercus aliena* Blume communities which are suntree was made up of seral stage secondary forest in the severely-destroyed mountain slope, and it is noted that *Quercus mongolica* Ficher is forming a community in the higher place than the upper mountain slope. And it showed that mixed forest where *Pinus densiflora* Siebold et Zuccarini being the main specie was sustaining a community in the mountain ridge. Therefore, as the vegetation unit of each community formed differently by the topography and sea height, and there appeared a lot of difference in sea height and breast height diameter growth, we can say that it is diserable to take advantage of these points when one surveys the forest condition and soil condition in managing natural park, setting up afforestation districts and making out the forestry plan.

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