Phytosociological Studies on the Beech Forest of Mt. Hakusan, Japan, with Particular Reference to the Relation between Vegetation Units and Soil Types*

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Introduction

The beech forest zone of the Northern Hemisphere, which shows analogous aspects in both physiognomy and composition to each other, can be traced through Europe, Asia and North America, although it is separated by oceans and arid areas. The beech forest is essentially confined to the temperate or montane regions, lying both altitudinally and horizontally in middle position. The forest, therefore, forms a key vegetation to solve several phytosociological and ecological problems.

Japanese beech, *Fagus crenata,* constitutes a dominant and important element of the Japanese cool-temperate, deciduous broad-leaved forests. Its forests are distributed from Kyushu, through Shikoku and Honshu, to the southern part of Hokkaido, ranging approximately from 31°30′N to 43°30′N. The beech forest has been well preserved in many sites of Japan, and therefore, it presents a suitable vegetation to elucidate the relationship between vegetation and soil factors. According to the recent knowledge of phytosociology, the *Fagus crenata* forest is divided into two alliances: 1. Saso-Fagion crenatae (Suz.-Tok. 1949) Miyawaki et al. 1964 and 2. Sasamorpho-Fagion crenatae (Suz.-Tok. 1949) Miyawaki et al. 1964. The former alliance, Saso-Fagion crenatae, is mainly found in the Japan Sea side where the climate is characterized by heavy snowfall in winter, whereas the latter develops on the Pacific side with contrastive climate. Soils of Japanese beech forests have been surveyed in accordance with the classification proposed by Ohmasa (1951) for the soil in the temperate zone of Tohoku district, northern Honshu. He classified the soils developing in the regions into three soil groups and 13 soil types. Recently the Forest Soils Division of the Government Forest Experiment Station of Japan

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(1975) established a new system of soil classification which was developed basically after Ohmasa's concept. Ohmasa (1951) and the Government Forest Experiment Station of Japan (1975), however, raised a doubt whether soil type is determined only by kind of vegetation, and they considered the topography as a main factor to determine the soil type. This suggests that the topography is a basic factor relating to the differentiation of both vegetation and soil features.

Mt. Hakusan, where the present study was carried out, is situated in the Japan Sea side of middle Honshu and supports well-developed beech forests which form a representative of the Saso-Fagion crenatae. As to the vegetation on Mt. Hakusan, a phytosociological study on the beech forest was first undertaken by Masamune (1960), who observed the forest in two sites and described it as *Fagus crenata–Viburnum furcatum–Ilex crenata* var. *radicans* association. Afterwards, T. Suzuki (1970) investigated the floristic composition and vegetation units of the beech forest of Mt. Hakusan, and identified it as Saso kurilensis-Fagetum crenatae. In the same year, the beech forest of Mt. Hakusan was recognized as association, Lindero membranaceae-Fagetum crenatae by Sasaki (1970) in his new classification of the beech forest of Japan. As Mt. Hakusan is situated in the middle of the whole range of this association, the phytosociological system proposed in this paper will imply the main body of the association in Japan. In the present study, the writer paid more attention to lower units of vegetation, such as subassociation, variant and subvariant, and the correlation between these units and soil types was studied in some details. In the course of the present study, phytosociological treatment was much developed, but writer's final aim was to explain ecological relationships between the vegetation units and soil types.

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This paper is dedicated to my teacher, the late Dr. Tokio Suzuki who died on March 10, 1978.

Area Investigated

1. Physiographic features

The present investigations were performed in the Hakusan National Park which is situated on the Japan Sea side of middle Honshu, called "Hokuriku region." The locality is shown in Fig. 1. The park covers an area of 47,402 ha lying between 36°05′N and 36°35′N latitude, 136°40′E and 136°58′E longitude, altitudinally ranging from 700 m to 2702 m. The main range of

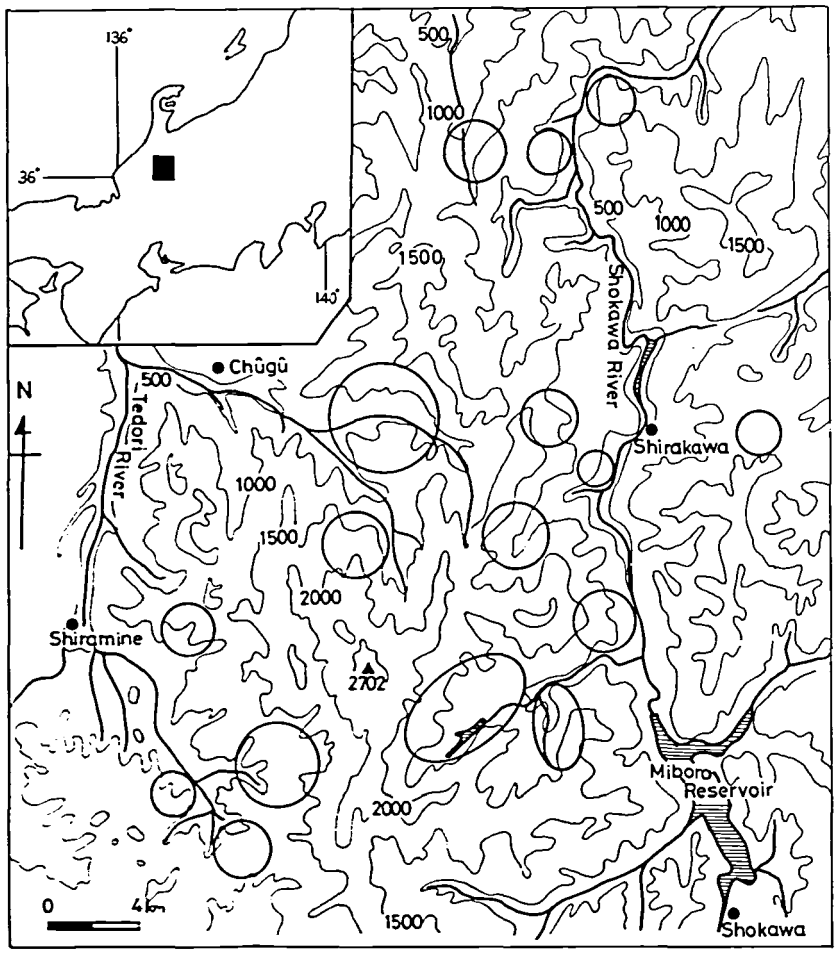

Fig. 1. A map showing the areas investigated. Soild circles show the meteorological stations.

the park stretches from north to south. Mt. Gozenpô (2702 m), the highest peak, lies at the center of this area. This mountain is a dormant volcano which has an accurate record of activities in 1554. Mt. Hakusan is known as a sacred mountain with a shrine at the summit which has been worshiped by people since ancient days. Because of such a mountain religion, the natural status of Mt. Hakusan has been well preserved. Consequently, the mountain provides a typical example of vertical zonation of vegetation for the Hokuriku region.

Hakusan National Park drains in two main rivers: the Tedorigawa River and the Shokawa River both of which flow northward to the Japan Sea. Most of the tributaries of these two rivers have large valleys and moderate slopes where *Fagus crenata* forests well develop. The Jadani, a tributary of the Tedorigawa River, cuts the northern part of the park into V-shaped valleys and steep ridges where the *Pinus parviflora* forest, which is an edaphic climax forest community, develops.

2. Geology

According to Kaseno et al. (1970), the Hida Metamorphic Complex forms a ground construction of this park. It belongs to one of the oldest rocks in Japan, perhaps before the Jurassic. The Tedori Group, dated from the Late Jurassic to the Middle Cretaceous, covers the Hida Metamorphic Complex with unconformity widely in west, south and southeast of the park. It is composed of several freshwater clastic sediments containing abundant fossils of molluscs and terrestrial plants. Rocks of the Nôhi Rhyolite, dated from the Late Cretaceous to the Paleogene, are exposed in the northern and eastern parts. Volcanic products of Hakusan Volcano cover the elevated basement consisting of the Tedori Group and the Nôhi Rhyolite. The material of the volcano is mainly composed of pyroxene hornblende andesite.

3. Climate

The climate of Japan is remarkably characterized by two contrasting types: the Pacific side and the Japan Sea side types. It is caused by the winter climate and the physiography of the Japanese archipelago lying nearly longitudinally between the Asian Continent and the Pacific Ocean. The winter monsoon is resulted from the facts that originally a dry continental air mass absorbs water vapor when it crosses the Japan Sea and changes itself into a moist air mass. When moist air mass ascends mountain slopes, it adiabatically expands and loses its vapor resulting in the heavy snowfall in the coastal regions of the Japan Sea. The monsoon which passed the peak lines of mountain ranges, having lost its vapor, changes itself again into a dry and cold descending air stream and brings winter dryness to the Pacific coast region. In summer, the warm equatorial air mass often brings high rainfalls in Japan, but the contrast between the Pacific and Japan Sea sides is not so remarkable as in winter.

Typical features of the two climate types of Japan are illustrated in upper hythergraphs in Fig. 2, where Kanazawa shows an example of the Japan Sea climate type and Nagoya that of the Pacific type.

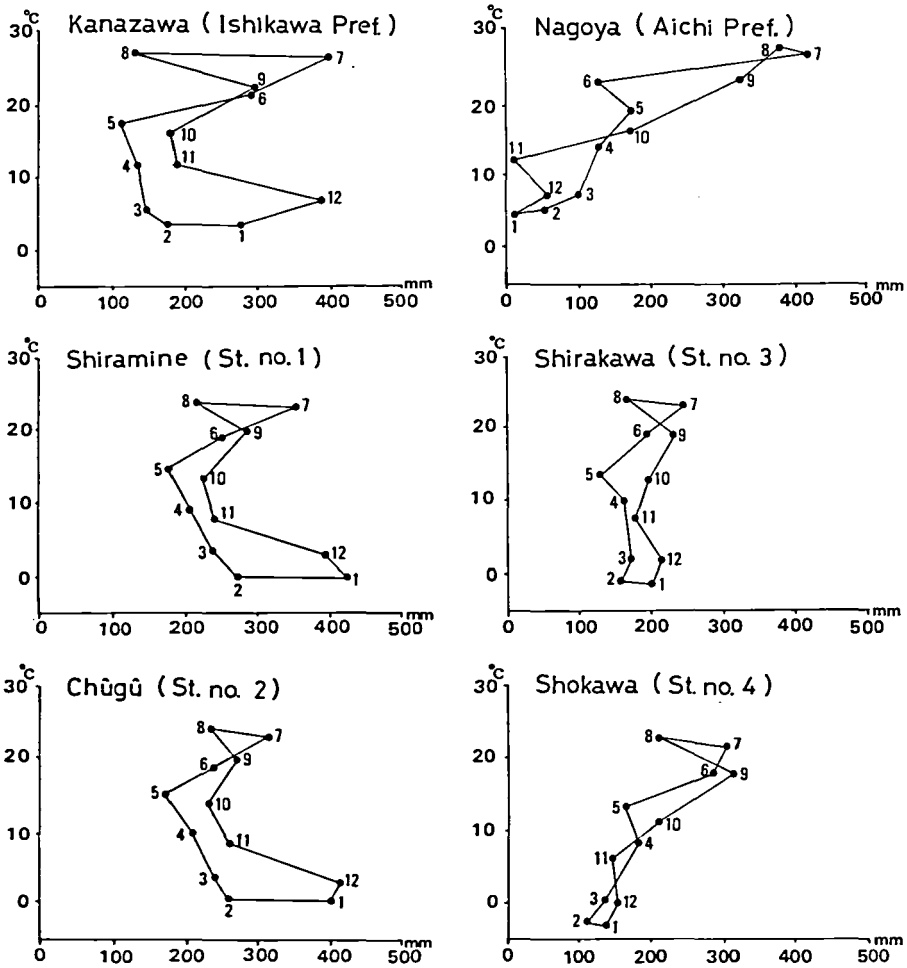

Fig. 2. Hythergraphs of Kanazawa, Nagoya and four stations near the area investigated. Temperature in °C on the vertical axis, precipitation in mm on the horizontal axis. All meteorological data used here are based upon the following publication: Annual Report of Climatological Stations 1972 (for Kanazawa and Nagoya); Weather of Hakusan (Kubo 1970) (for St. nos. 1–4).

In order to estimate the climate of the investigated area, four of the near-by meterological stations were chosen (Table 1). Data of air temperature were corrected into values at the elevations of 1000 m and 1500 m because elevations of the stations are far lower than those of the investigated area. The air temperature and the precipitation at each station are shown in hythergraphs in Fig. 2. From the data in Table 1, at the localities of elevations 1000 m and

Table 1. Meteorological data of four localities near the area investigated

Station	East long.	North Lat.	Alt. (m.s.m.)	Annual mean temperature (°C)	Monthly mean temp. in summer (June, July, Aug. °C)	Monthly mean temp. in winter (Dec., Jan., Feb. °C)	Mean of annual total precipitation (mm)	Total precip. in summer (mm)	Total precip. in winter (mm)
No.1 Shramine	136°38'	36°10'	480	11.4(8.8*,6.1**)	22.0(19.4*,16.7**)	1.1(-1.7*,-4.5**)	3238	870	1066
No.2 Chûgû	136°42'	36°17'	456	11.6(8.9 ,6.3)	22.1(19.4 ,16.7)	1.2(-1.6 ,-4.3)	3243	789	1075
No.3 Shirakawa	136°55'	36°15'	496	10.8(8.2 ,5.5)	21.9(19.3 ,16.6)	-0.3(-3.1 ,-5.9)	2220	595	567
No.4 Shokawa	136°58'	36°02'	786	9.5(8.4 ,5.8)	20.6(18.7 ,16.9)	-2.0(-3.3 ,-6.1)	2377	798	402

All meteorological data used here are based upon the following publication : Weather of Hakusan, Kubo 1970. Parenthesized figures (*,**) show values corrected into those at altitudes 1000m and 1500m respectively. Lapse rate of air temperature per 100 m used here follows Kubo (1970).

1500 m, the temperature is estimated as 8.6°C and 5.9°C for annual mean, −2.4°C and −5.2°C for winter mean (the average of December, January and February) and 19.2°C and 16.7°C in summer mean (the average of June, July and August) respectively. Annual mean precipitation attains over 2200 mm in any locality. It is clear that these data show the climatic characteristics of the cool-temperate zone of Japan. There is no remarkable difference of temperature between the eastern and western stations, but the precipitation gradient shows a clear increase westward. The difference attains the maximum in winter, namely, 570 mm at Shirakawa (east) while over 1050 mm at Chûgû and Shiramine (west). This area is one of the regions with the heaviest snowfall in Japan, and the west side of the main range has clearly more snow than the east side. For example, in 1968 the maximum snow depth reached 335 cm at Chûgû and Shiramine, and 253 cm at Shirakawa. This fact suggests that the Hakusan range makes a front of the heavy snowfall of the Japan Sea coast. From the actual measurement at Chûgû, Kubo (1970) estimated the snow accumulation to be 4–7 m in the area of the beech forests. These climatic characteristics seem to be important in discussing the vegetation of this area.

Methods of Studies

1. Vegetation

The present study follows the methodology of the Braun-Blanquet school of plant sociology (Braun-Blanquet 1951, 1964). In the field, homogeneous stands were chosen. Shape of the stand was usually square, but sometimes rectangular by the condition of forest site. The minimal area of the stand was determined by the species-area curve, where the ratio between species and area became 1: 1. Size of the stand was approximately 15×15 m. It agrees with the size used by Sasaki (1970) in his monographic study of the Japanese beech

forests. In some cases, the smaller size was used in consideration of the homogeneity of the stand.

The total coverage of the stand and the height of each layer were recorded. Six layers are generally distinguished in the beech forest. They include: lower herb layer, below 0.2 m, mostly composed of sedges; upper herb layer, 0.2–0.5 m, generally of ferns; lower shrub layer, 0.5–1.0 m, dominated by creeping evergreen shrubs; upper shrub layer, 1.0–3.0 m; subtree layer, 3.0–8.0 m; and tree layer, above 8.0 m. The species dominance in each layer was estimated by the scale of the combined coverage-abundance of Szafer-Pawlowski (1927) and Braun-Blanquet (1951, 1964). The following physiographical features of the stand were recorded: altitude (m), aspect and degree of the slope, and topography. The topographic condition was shown by the following symbols: f=flat or fan, l=lower part of slope, m=middle part of slope, u=upper part of slope, r=ridge, and v=valley.

Phytosociological data were treated following Ellenberg (1956) by tabular comparison and summarized into a synthesis table. The presence was expressed in five classes (I–V) according to the percentage of the stand frequency. Character species of the association were determined by comparison of the synthetic tables of the beech and other forests reported by various authors from Mt. Hakusan. The latter included *Populus maximowiczii-*, *Abies mariesii-*, and *Betula ermanii* forests by Masamune (1960), Ravine-, *Tsuga diversifolia-* and *Betula ermanii–Abies mariesii* forests by T. Suzuki (1970), *Pinus densiflora-*, *Quercus serrata–Q. variabilis-*, and *Quercus serrata–Q. mongolica* var. *grosseserrata* forests by Hukusima et al. (1973). Furthermore, some other records of the present author and the data of distribution pattern of woody plants in Hakusan by Takahashi (1962) were referred. Nomenclature of the species follows "Flora of Japan" by J. Ohwi (1972) and "Colored Illustrations of Bryophytes of Japan" by Z. Iwatsuki & M. Mizutani (1972).

2. Soils

Soil profiles were observed at a representative part in the sample quadrat of vegetation through soil pits or material collected based on the quidelines by the Government Forest Experiment Station of Japan (1971). In every soil profile, the following soil properties were recorded: drainage, color, structure, texture, form and disposal of organic matter, leaching and accumulation of bases, penetration and development of roots, and stoniness; soil color was determined on fresh soil with Standard Soil Charts (1970). The mode of deposition (c=colluvial, d=deluvial and r=residual) was also observed. Soil profiles were photographed and soil samples were collected from various horizons of the profile for pH and soil moisture determination. Measurement of pH was made on 1: 2.5 suspension of soil in distilled water with a glass electrode. The soil moisture was determined as percentage by dry weight at 105°C and converted into volume percent.

Classification of Vegetation

Beech association and ecological aspect of component species

I. Association, Lindero membranaceae-Fagetum crenatae Sasaki 1970, Vegetatio 20: 219, Table 1. (Table 2)

Character species: *Fagus crenata, Acer japonicum, A. sieboldianum, A. micranthum, Magnolia salicifolia, Skimmia japonica* forma *repens, Daphniphyllum macropodum* var. *humile, Ilex leucoclada, Carex morrowii* var. *temnolepis, Goodyera maximowicziana, Smilacina japonica, Paris tetraphylla, Dolichomitriopsis diversiformis, Hylocomiopsis ovicarpa, Brachythecium coreanum, B. rhynchostegielloides, B. brotheri, Hypnum fujiyamae.*

The beech forest occupies the largest area in the vegetation on Mt. Hakusan. According to the vegetation map of the Hakusan National Park by T. Suzuki & Hukusima (1972), the beech forest covers an area of about 3,280 ha (ca. 64.6%) in this park. It develops at altitudes ranging from 700 m to 1700 m and establishes a clear belt between 800 m and 1550 m. The upper boundary of the beech forest borders on the subalpine birch-fir forest (Abietum mariesii Suz.-Tok. 1954). At the lower part the submontane oak forest (Querco-Castanetum Karizumi 1956) is in contact with the beech forest. In the montane zone, two edaphic climax forests develop neighboring to the beech forest. One is the pine forest (Rhodoreto-Thujetum Usui 1955) which develops on drier ridges or the upper part of steep slopes. The other is the ravine forest (Polysticho-Pterocaryetum Suz.-Tok. et al. 1955) which usually develops along a rivulet of the valley bottom.

On Mt. Hakusan the Lindero membranaceae-Fagetum crenatae is strikingly characterized by the above-cited character species. According to Sasaki's concept, this association includes most of the character species of its higher ranks. *Acer japonicum, Daphniphyllum macropodum* var. *humile, Ilex leucoclada* and *Goodyera maximowicziana* are character species of the alliance, Saso-Fagion crenatae. The remaining species, except *Carex morrowii* var. *temnolepis,* are character species of the order, Saso-Fagetalia. *Carex morrowii* var. *temnolepis,* which was described by Sasaki as a differential species of the *Carex morrowii* var. *temnolepis* subassociation, becomes a local character species of this association on Mt. Hakusan.

On a comparison of beech forests of the whole Japan, it is known that the character- and differential species of this association recognized by Sasaki (1970), such as *Aucuba japonica* var. *borealis, Lindera umbellata* var. *membranacea, Rumohra mutica, Prunus grayana, Shortia uniflora, Rhododendron albrechtii, Hamamelis japonica* var. *obtusata, Acer tschonoskii, Streptopus streptopoides* var. *japonicus* and *Clintonia udensis,* play a role as characteristic species of this association. But in Mt. Hakusan, it is emphasized that those species play role of the differential

species of the association because of the following reason. Many of those species are transgressive to other neighboring forests, for example, *Aucuba japonica* var. *borealis, Prunus grayana, Lindera umbellata* var. *membranacea, Hamamelis japonica* var. *obtusata* and *Shortia uniflora* are common both to the beech and to the submontane oak forests, although they are lacking in the subalpine birch-fir forest. On the other hand, *Acer tschonoskii, Rhododendron albrechtii, Clintonia udensis* and *Streptopus streptopoides* var. *japonicus* are found in both the beech and the birch-fir forests, but do not occur in the oak forest. Consequently, although the beech forest on Mt. Hakusan is characterized by the local character species, the transgressive species including the character- and differential species designated by Sasaki play a significant role in the floristic composition of the beech forest on Mt. Hakusan.

As to the stratification of the beech forest on Mt. Hakusan, we can distinguish six layers. Generally, the beech forest on Japan Sea side, in its typical structure, is represented by the following stratified combination of genera: *Fagus* (tree-)–*Acer* (subtree-)–*Sasa* (upper shrub-)–*Ilex, Skimmia, Daphniphyllum* (lower shrub-)–*Plagiogyria, Rumohra* (upper herb-)–*Carex* (lower herb-layer). Among these genera, *Fagus* and *Acer* link the beech forests of the northern hemisphere. Occurrence of *Sasa* is especially characteristic of the East Asian beech forests. The genera of the lower shrub and the herb layers are diagnostic to the beech forests in the Japan Sea side region.

II. Ecological groups of the component species (Table 2)

Grouping of taxa should be considered in two ways when we intend to solve the problems concerning the relation between syntaxa and environmental conditions phytosociologically. One is to find out the fidelity of taxa to vegetation units, the other is the relation to the ecological factors.

1. Transgressive species groups of the two vertical zones

The beech forests are widely distributed in the montane zone of Mt. Hakusan which forms a large mountain mass, and gradually replaced upward by the subalpine birch-fir forest and downward by the submontane oak forest. Many species are found transgressively in the vertical zones of the district. Moreover, many of these species were treated as the character species of subalpine conifer forests of Japan (Jinno & H. Suzuki 1973) or of pine forests (Toyohara 1973).

1) Transgressive species between the beech and the subalpine birch-fir forests

Viburnum furcatum, Sasa kurilensis, Sorbus commixta, Menziesia pentandra, Rhododendron albrechtii, Acer tschonoskii, Plagiogyria matsumureana, Rumohra mutica, Carex dolichostachya var. *glaberrima, Maianthemum dilatatum, Clintonia udensis, Streptopus streptopoides* var. *japonicus, Lycopodium serratum* var. *serratum, Dicranum viride* var. *hakkodense, D. scoparium, Dolichomitriopsis crenulata, Hylocomium pyrenaicum, Hypnum*

pallescens, Rigodiadelphus robustus, Callicladium haldanianum, Trachycystis flagellaris.

These species have a nearly common requirement to the temperature, and are all cold-resistant, but some ecological difference seems to exist between the vascular plants and mosses. The vascular plants forming the undergrowth of forests are protected under the heavy snowcover during winter. As subtrees and shrubs are covered with the snow, their winter buds are well protected from the severe cold wind by the snowcover. Mosses are, on the other hand, corticolous for the most part. They are thus exposed to the winter wind, and need be tolerant with the coldness. For example *Viburnum furcatum* and *Sasa kurilensis,* representatives of woody undergrowth, should well be adapted to the snowcover in winter. *Dicranum viride* var. *hakkodense* and *Rigodiadelphus robustus* are representative epiphyte mosses which are exposed to harsh winter air.

2) Transgressive species between the beech and the submontane oak forests

Quercus mongolica var. *grosseserrata, Sorbus alnifolia, Hamamelis japonica* var. *obtusata, Clethra barbinervis, Fraxinus lanuginosa, Prunus grayana, Acer rufinerve, Symplocos paniculata, Lindera umbellata* var. *membranacea, Rhus trichocarpa, Aucuba japonica* var. *borealis, Vaccinium japonicum, Ilex crenata* var. *paludosa, Disporum smilacinum, Blechnum niponicum, Mitchella undulata, Rhus ambigua, Schizophragma hydrangeoides.*

Most species of this group have similar temperature requiments, and grow in warmer regions than those of the preceding group. *Hamamelis japonica* var. *obtusata, Ilex crenata* var. *paludosa* and *Aucuba japonica* var. *borealis* have been related to the condition of snowcovering in differentiating from the typical race. *Hamamelis japonica* var. *obtusata, Vaccinium japonicum* and *Mitchella undulata* are rather susceptible to water stagnancy, while *Prunus grayana, Acer rufinerve, Rhus ambigua* and *Schizophragma hydrangeoides* are sensitive to dryness.

1. Species groups in relation to moisture conditions

Occurrences of the foregoing two groups are related to the temperature or altitude, but there is another group which is regulated by soil moisture conditions.

1) Species of moist soil element

Acer mono, A. palmatum var. *matsumurae, Tilia japonica, Cephalotaxus harringtonia* var. *nana, Euonymus oxyphyllus, E. alatus* forma *ciliatodentatus, Dryopteris sabaei, Athyrium otophorum, Hydrangea petiolaris, Thamnobryum alopecurum.*

Most of the above species are important elements in the ravine forest, Polysticho-Pterocaryetum. The topography of their habitats is always inclined where water supply is well provided. They are not tolerate with water stagnancy.

2) Species of dry soil element

Rhododendron nudipes, R. kaempferi, Tripetaleia paniculata, Ilex sugerokii var. *brevipedunculata, Menziesia multiflora, Shortia uniflora, Heloniopsis orientalis, Leuco-*

bryum neilgherrense.

These species grow dominantly in dry habitats on the ridge. They are transgressive species from the Rhodoreto-Thujetum, an edaphic climax developing on drier soil of the montane region. They are divided into two subgroups. *Rhododendron nudipes, R. kaempferi* and *Leucobryum neilgherrense* are transgressive species to the true *Pinus densiflora* or oak forests at the lower altitude, where these species grow commonly on drier soil. The others, however, not only prefer topographically dry sites but also sometimes occur in undrained places around the moor. This apparently contradictory behavior will be explained by physiological dryness of the latter habitat.

Subassociation and their lower units

A. Subass. camellietosum Sasaki 1970, Vegetatio 20: 223, Table 1 (Table 3)

Differential species: *Camellia rusticana.*
Altitudinal range: 750–1050 m.
Number of component species: 35 (27–42).

The occurrence of this subassociation is restricted to the northern part of Mt. Hakusan, where the slope becomes less steep toward the coast of the Japan Sea. Peaks do not exceed 1300 m and their average elevation is as low as 1100 m. Thus the climate is warmer with a shorter period of snow-cover than the other parts of Mt. Hakusan. The undergrowth is characterized by the luxuriant growth of evergreen and creeping *Camellia rusticana.* The cooccurrence of *Camellia rusticana* and *Fagus crenata* is an essential character of this forest. The snowy condition providing sufficient protection in winter may be a necessary factor for such an evergreen broad-leaved shrub to thrive under the deciduous beech canopy. *Camellia rusticana* is an akin of *Camellia japonica. Aucuba japonica* var. *borealis,* which is another evergreen shrub found on the Japan Sea side, is also closely related to its typical race. *Camellia japonica* and *Aucuba japonica* var. *japonica* coexist almost constantly in the evergreen broad-leaved forest in the northern part of its range. It is quite certain that the subassociation, camellietosum, has been formed in the region where the beech forest contacts with the evergreen broad-leaved forest under the snowyc limate along the Japan Sea coast.

This subassociation is subdivided into two variants: the typical and *Cephalotaxus harringtonia* var. *nana* variant.

A-1. Typical variant

This variant is widely distributed in drier and somewhat well-drained sites on the gentle slopes facing SW–SE. It is composed only of the essential components of the subassociation. There is remarkable rich growth of *Acanthopanax sciadophylloides, Quercus mongolica* var. *grosseserrata* and *Monotropastrum globosum.*

Table 3. Camellietosum
1. Typical variant; 2. *Cephalotaxus harringtonia* var. *nana* variant

Variant	1									2								
Quadrat number	HD 14	DA 5	DA 14	DA 10	DA 11	DA 7	DA 13	DA 12	DA 6	DA 9	DA 4	HD 15	DA 19	HD 16	DA 17	HD 13
Year of record	75	71	71	71	71	71	71	71	71	71	71	75	71	75	71	75
Altitude (m)	480	460	440	440	440	460	470	450	460	490	490	1040	1090	1030	1030	1015
Slope aspect (°)	E	SE	SW	SW	SW	SE	NE	SE	NW	SW	SW	SE	NE	NE	NE	NE
Slope degree (°)	20	45	40	65	80	80	80	80	40	10	30	40	40	50	W	20
Microtopography	5	25	43	20	30	10	15	30	50	40	12	30	25	25	28	20
Size of plot area (m^2)	r 15	r 15	m 12	u 16	m 16	m 16	f 16	m 16	m 16	u 15	l 15	u 16	u 16	u 16	u 16	m 20
Height of tree layer (m)	10	24	20	25	25	20	17	20	24	24	22	12	10	12	20	13
Cover of tree layer (%)	70	75	85	90	90	40	80	95	95	95	85	90	80	80	95	90
Height of subtree layer (m)	6	4	6	4	5	6	6	5	6	4	6	6	5	6	5	5
Cover of subtree layer (%)	85	40	60	70	40	60	60	60	40	40	60	80	60	80	50	85
Height of upper shrub layer (m)	1.5	2.0	2.0	1.5	2.0	2.5	1.5	1.5	2.0	2.0	2.0	2.0	1.5	1.5	2.0	2.0
Cover of upper shrub layer (%)	90	90	95	95	95	90	65	70	70	90	90	75	80	75	60	80
Height of lower shrub layer (m)	0.8	0.5	0.5	•	0.6	0.5	0.6	0.5	0.5	0.5	0.8	0.7	0.8	0.8	0.6	0.7
Cover of lower shrub layer (%)	45	30	30	•	20	20	30	30	30	30	20	30	30	30	20	20
Height of upper herb layer (m)	•	•	0.3	0.5	•	•	•	•	0.3	•	•	•	0.3	0.5	•	0.3
Cover of upper herb layer (%)	•	•	30	20	•	•	•	•	20	•	•	•	20	20	•	35
Height of lower herb layer (m)	0.1	0.1	0.1	•	0.1	•	0.1	0.2	0.1	•	0.1	0.1	•	•	0.2	•
Cover of lower herb layer (%)	50	80	30	•	20	•	25	10	30	•	30	30	•	•	85	•
Number of species	35	36	28	33	31	27	38	32	34	30	39	41	36	36	42	43
Soil type	B_D	B_B	B_B	$B_{B(D)}$	•	•	•	$B_{D(B)}$	B_B	$B_{B(D)}$	B_D	$B_{D(B)}$	B_D	$B_{D(B)}$	•	$B_{D(B)}$
Mode of deposition	r	r	d	r	•	•	•	d	r	r	r	r	r	r	•	r
Differential species of Subassociation																
Camellia rusticana	4.4	3.4	2.2	3.4	5.5	1.1	3.3	4.4	4.4	5.5	4.4	4.4	4.4	4.4	3.3	3.3
Differential species of Variant																
Cephalotaxus harringtonia var. *nana*	•	•	•	•	•	•	•	•	•	1.1	•	+	+2	+	+	+2
Dryopteris sabaei	•	•	•	•	•	•	•	•	•	•	+	1.1	+	1.1	1.1	+2
Lycopodium serratum var. *serratum*	•	•	•	•	•	•	•	•	•	+	•	+2	+	+2	+	•
Thamnobryum alopeculum	•	•	•	•	•	•	•	•	•	•	•	+	+	+	+	•
Euonymus alatus forma *ciliatodentatus*	•	•	•	•	•	•	•	•	•	+	•	•	+2	•	•	+
Smilacina japonica	•	•	•	•	•	•	•	•	•	•	+	•	•	•	+	+
Rhus ambigua	•	•	•	•	•	•	•	•	•	•	+	•	•	+	•	+2
Character species of Association																
Fagus crenata	4.4	5.5	5.5	4.4	5.5	2.2	5.5	4.4	3.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Ilex leucoclada	+2	1.1	+	+	+	1.1	+	•	1.1	•	+	+	+	+	+	+
Dolichomitriopsis diversiformis	+2	1.2	+	+	+2	+2	1.2	+2	+2	1.2	1.2	+2	1.2	+2	+	1.2
Brachythecium brotheri	+	•	•	+2	+	+2	+	+	+	+2	1.2	+2	1.2	+2	1.2	1.2
Acer japonicum	•	•	•	•	1.1	2.2	1.1	+	3.3	+	•	1.1	1.1	2.2	1.2	+2
Magnolia salicifolia	1.1	1.1	1.1	+	•	+	+	1.2	•	•	+	+	•	+	+	•
Brachythecium rhynchostegielloides	+	+	•	•	+	•	+	+	•	•	•	+2	+2	+2	•	+
Daphniphyllum macropodum var. *humile*	2.2	1.1	•	•	+	•	2.2	•	•	•	+	1.1	•	1.1	+	•
Paris tetraphylla	+	•	•	+	•	•	•	•	•	+	+	+	•	+	+	+
Acer micranthum	1.1	+	•	+	•	•	+	•	•	•	•	1.1	+	•	+	•
Hylocomiopsis ovicarpa	•	•	•	+2	•	•	+	•	+	+	•	•	+	•	+	•
Acer sieboldianum	1.1	•	1.2	•	•	3.3	•	•	•	•	•	2.2	•	+	•	1.1
Carex morrowii var. *temnolepis*	•	•	+2	•	•	•	•	•	+	•	•	•	•	+2	1.2	•
Skimmia japonica forma *repens*	•	•	•	•	•	•	1.1	•	•	•	•	+	+2	•	+	•
Goodyera maximowicziana	+2	•	•	•	•	•	•	•	•	•	•	+2	+2	+	•	+
Brachythecium coreanum	•	•	•	•	•	•	•	+	•	•	•	•	•	•	+	+2
Hypnum fujiyamae	•	•	•	+2	•	•	+2	•	•	•	•	•	•	•	•	•
Transgressive species to the subalpine birch-fir forest																
Dicranum viride var. *hakkodense*	+2	+2	+2	1.2	1.1	+	+2	+2	+	+2	+2	+	+2	+2	1.2	+2
Viburnum furcatum	3.3	3.3	1.1	3.3	3.3	•	2.2	2.2	1.2	3.3	4.4	3.3	2.2	3.3	3.3	4.4
Sasa kurilensis	2.2	3.3	3.3	3.3	3.3	5.5	1.2	1.1	•	1.1	2.2	3.3	2.2	1.2	1.1	3.3
Plagiogyria matsumureana	•	+	2.2	+	+	•	•	+	1.1	•	+	1.1	1.1	+	1.1	1.2
Rumohra mutica	+	1.1	•	1.1	+	•	+	•	•	•	+	+2	1.2	•	+	•
Sorbus commixta	+	+	•	•	•	1.2	+	•	+	•	+	+	+2	•	1.1	•
Carex dolichostachya var. *glaberrima*	•	+	•	•	•	•	•	•	•	1.1	•	•	•	•	+	+
Maianthemum dilatatum	+	•	•	•	•	•	•	•	•	+	•	•	•	•	•	•
Streptopus streptopoides var. *japonicum*	•	•	•	•	•	•	•	•	•	•	+	•	•	•	•	•
Transgressive species from the submontane oak forest																
Lindera umbellata var. *membranacea*	+2	1.1	+	1.1	1.1	1.1	+	+	1.1	+	+	+2	+2	+	1.1	+
Clethra barbinervis	1.2	1.1	1.2	3.3	•	•	2.2	2.2	+	+	2.2	1.2	+2	1.1	+	1.1
Schizophragma hydrangeoides	+	+	•	+	1.1	1.1	+	+	+	+	•	+	+2	•	+	+2
Rhus trichocarpa	1.2	+	•	+	+	+	+	+	+	+	+	•	•	+	+	•
Aucuba japonica var. *borealis*	•	1.1	1.1	+	1.1	•	•	1.1	•	1.1	1.1	2.2	1.2	1.2	1.1	1.1
Hamamelis japonica var. *obtusata*	3.3	1.1	1.1	•	•	1.2	1.1	+	1.2	1.1	2.2	2.2	•	•	1.1	•
Fraxinus lanuginosa	+2	•	1.1	•	+	+	•	+	•	•	•	+	1.1	1.1	•	+2
Mitchella undulata	1.2	1.1	•	•	•	•	1.2	+2	•	•	2.2	+2	+2	+2	1.1	•
Acer rufinerve	+2	•	+	+	•	1.2	+	•	•	•	+	+	•	•	•	1.1
Symplocos paniculata	•	+	•	•	+	1.1	+	+	•	•	+	•	+2	•	•	+2
Quercus mongolica var. *grosseserrata*	•	2.1	+	3.3	•	2.2	2.1	3.3	4.4	3.3	•	•	•	•	•	•
Sorbus alnifolia	+	•	1.1	+	•	•	•	•	•	•	1.1	1.1	1.1	1.1	•	•
Blechnum niponicum	•	•	+	•	+	•	+	+2	+	+	1.1	•	•	•	•	•
Vaccinium japonicum	+	1.1	+	•	•	•	1.1	•	1.1	•	+	•	•	•	•	•
Disporum smilacinum	•	•	+	•	•	+	•	+	•	•	1.1	•	•	•	+	•
Prunus grayana	+	•	•	•	+	+	•	•	•	•	•	•	+	•	•	•
Ilex crenata var. *paludosa*	•	•	•	•	•	•	+	•	•	•	•	•	•	•	•	•

	HD 14	DA 5	DA 14	DA 10	DA 11	DA 7	DA 13	DA 12	DA 6	DA 9	DA 4	HD 15	DA 19	HD 16	DA 17	HD 13
Moisture elements																
Acer palmatum var. *matsumurae*	·	·	1.1	1.2	2.1	2.1	·	·	·	1.1	1.1	+	·	·	·	1.1
A. mono	·	·	·	·	2.1	·	·	·	·	2.1	·	·	·	·	·	1.1
Tilia japonica	·	·	·	·	·	·	·	·	·	·	·	1.2	·	+	·	·
Euonymus oxyphyllus	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·
Athyrium otophorum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+
Dry elements																
Shortia uniflora	3.3	4.4	2.2	·	·	·	1.2	·	2.2	·	·	3.3	·	·	4.4	·
Heloniopsis orientalis	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·
Leucobryum neilgherrense	·	·	·	+	·	·	·	+	·	·	·	·	·	·	·	·
Tripetaleia paniculata	·	·	·	·	·	·	·	·	1.1	·	·	·	·	·	·	·
Menziesia multiflora	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·
Companions																
Thuidium kanedae	+	+	1.2	+.2	+	+.2	·	+.2	+	1.2	+	+	+	+.2	+.2	·
Fauriella tenuis	+	+	1.2	1.2	+.2	+	+.2	+.2	+	+	1.2	+	·	+	+.2	+
Acanthopanax sciadophylloides	1.1	+	·	+.2	+	1.1	+	+	·	·	·	·	·	·	·	1.1
Monotropastrum globosum	·	1.1	·	+	+	1.1	+	+	+	·	·	·	+	·	·	·
Magnolia obovata	·	+	·	·	·	·	1.1	1.2	·	·	·	·	1.1	2.1	1.1	1.1
Fissidens cristatus	·	+.2	·	·	+	·	+.2	·	·	+	·	+	+	·	·	+
Ardisia japonica	·	+	·	+	1.1	·	·	·	·	+	·	·	+	·	+	·
Smilax nipponica	+	·	·	·	·	·	·	·	·	·	·	·	·	+	+	+
Brachythecium populeum	+	+.2	·	·	·	·	·	·	·	+	·	·	·	·	+	·
Thuidium bipinnatulvm	·	·	·	+	·	·	·	·	·	+	·	·	+	·	·	·
Rhynchostegium pallidifolium	·	·	·	+.2	·	·	·	·	+.2	·	·	·	·	·	·	·
Corylus sieboldiana	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	+
Asarum takaoi	·	·	·	·	·	·	·	·	·	·	+	·	+.2	·	·	·
Plagiothecium nemorale	·	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·
Betula grossa	·	·	·	2.1	·	2.1	·	·	·	·	·	·	·	·	·	·
Peracarpa carnosa var. *circaeoides*	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+.2
Pertya rigidula	·	·	1.1	·	·	·	·	·	+	·	·	·	·	·	·	·
Fissidens japonicus	·	·	·	·	+.2	·	·	·	+.2	·	·	·	·	·	·	·
Anomodon rugelii var. *rugelii*	·	·	·	+.2	·	·	·	·	·	·	·	·	·	·	·	·
Solidago virga-aurea var. *asiatica*	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·
Pyrola japonica	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·
Polygonatum lasianthum	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·
Cornus kousa	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·
Platanthera florentii	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·
Dryopteris austriaca	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1.1
Ainsliaea acerifolia var. *subapoda*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	2.2
Astilbe thunbergii var. *congesta*	·	·	·	·	·	·	·	·	1.1	·	·	·	·	·	·	·
Myuroclada maximowiczii	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·
Cornus controversa	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	2.2
Athyrium squamigerum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+

A-2. *Cephalotaxus harringtonia* var. *nana* variant

Differential species: *Cephalotaxus harringtonia* var. *nana, Dryopteris sabaei, Lycopodium serratum* var. *serratum, Thamnobryum alopecurum, Euonymus alatus* forma *ciliatodentatus, Smilacina japonica, Rhus ambigua.*

This variant occupies flat sites or gentle slopes facing the north, where soil is more moist than the former variant. Moist soil elements such as *Cephalotaxus harringtonia* var. *nana, Euonymus alatus* forma *ciliatodentatus* and *Dryopteris sabaei* occur more frequently here.

B. Subass. aesculetosum (Suz.-Tok. 1952 ex Usui 1955) comb. nov. (Table 4)

Syn. Saso kurilensis-Fagetum crenatae aesculetosum Suz.-Tok. 1952, ex Usui 1955, Jap. Jour. Ecol. 5: 28, Table 2 (4 records from Yunishikawa).

Differential species: *Dryopteris crassirhizoma, Hydrangea macrophylla* var. *megacarpa, Aesculus turbinata, Ligustrum tschonoskii, Polystichum tripteron, Dryopteris monticola, Polystichum retroso-paleaceum.*

Altitudinal range: 940–1380 m.

Number of component species: 44 (31–51).

This forest is distinguished from others by the significant occurrence of the

Table 4. Aesculetosum

1. *Dryopteris austriaca* variant; 2. *Acer palmatum* var. *matsumurae* variant: a. *Pterocarya rhoifolia* subvariant, b. Typical subvariant, c. *Cornus kousa* subvariant

Variant	1	2		
Subvariant		a	b	c
Quadrat number	46	53	47	51	52	9	41	49	8	43	62	13	42	13	15	14	27	63	64	7	51
Year of record	72	75	75	75	75	70	74	75	70	74	71	72	71	76	76	76	74	74	74	74	75
Altitude (m)	1220		1320		1200		1260		940		1060		1 65		1225		1190		1300		1250
Slope aspect (°)		1225		1230		1250		1150		1220		1380		1260		1270		1182		1260	
Slope degree (°)	NE	SW	NE	SW	W	SE	NW	NE	SW	–	NW	SE	NE	SE			SW	SW	SW	SE	S
Microtopography	40	80	15	35		20	20	30	15	–	35	15	5	40	–	5	65	75	80	75	
Size of plot area (m²)	22	5	20	5	25	20	40	35	10	–	35	20	30	15	–	5	20	55	45	30	45
Height of tree layer (m)	17	17	18	16	15	24	19	18	19	18	20	18	20	15	16	15	17	15	15	17	22
Cover of tree layer (%)	80	90	95	80	85	95	100	100	100	100	90	80	80	100	90	90	100	85	85	100	85
Height of subtree layer (m)	4	5	5	4	5	6	4	4	6	4	5	6	5	5	5	6	8	6	6	6	6
Cover of subtree layer (%)	50	80	75	90	65	80	40	65	60	50	60	85	70	70	75	70	40	60	70	75	70
Height of upper shrub layer (m)	1.5	1.0	1.0	1.0	1.0	1.5	1.0	1.0	1.5	1.5	1.2	1.0	1.0	1.8	1.5	1.5	1.5	1.0	1.2	1.0	1.5
Cover of upper shrub layer (%)	40	60	30	40	70	70	70	50	85	85	40	60	80	80	70	60	100	80	60	30	60
Height of lower shrub layer (m)	·	·	0.7	·	0.5	·	·	0.5	·	·	0.5	0.5	0.6	·	0.5	0.6	0.7	·	·	·	·
Cover of lower shrub layer (%)	·	·	20	·	10	·	·	10	·	·	10	10	50	·	30	10	20	·	·	·	·
Height of upper herb layer (m)	1.0	0.5	0.5	0.4	0.5	0.6	0.5	0.6	0.7	0.5	0.6	0.8	0.4	·	0.6	0.5	0.5	0.5	0.8	·	0.4
Cover of upper herb layer (%)	80	85	80	70	70	40	40	65	30	20	30	60	30	·	30	40	30	40	70	·	60
Height of lower herb layer (m)	0.1	0.1	0.1	0.1	0.2	0.2	·	0.1	0.1	0.1	0.2	0.2	·	0.1	0.1	0.2	0.1	0.1	0.1	0.1	·
Cover of lower herb layer (%)	30	95	50	80	100	40	·	50	100	100	30	95	·	40	30	20	60	50	30	40	·
Number of species	32	48	53	43	40	42	52	42	54	46	46	40	43	39	44	45	53	44	39	41	46
Soil type	Br	Br	Bp	Be	Be	·	Be	Be	Be	Bp	Be	Be	Be	Be	·	Be	Bp	Be	Be	Bp	·
Mode of deposition			d						d								d			d	
Differential species of Subassociation																					
Dryopteris crassirhizoma	2.2	+	2.1	·	1.1	1.1	1.1	3.3	2.2	2.2	2.2	1.2	1.1	3.3	3.1	1	+	2.1	1.1	1.1	2.2	2.4	4	·	+	2
Hydrangea macrophylla	3.3	1	2.1	2	1.1	1.1	1.1	·	+	2.2	2	·	·	+	2.1	1	·	1.2	+	2	+	+	+	2	·	+	2.1	2
Aesculus turbinata	3.2	·	3.3	2.1	+	3.3	3.3	4.4	3.3	4.4	·	·	2.2	3.2	2.2	3.3	3	+	2	·	·	2.1	·			
Ligustrum tschonoskii	·	·	·	+	+	2	·	·	+	1.1	1.1	2.2	1.1	2.2	+	2	+	1.1	+	1.1	+	2	1.1	·	1.1	
Polystichum tripteron	1.2	+	2	+	+	2	·	+	+	2.2	+	2	+	·	·	+	·	·	·	·	1.1	·	·	·	·	
Dryopteris monticola	2.2	·	·	1.2	2.2	+	·	·	·	·	·	·	+	3.3	+	1.2	3.3	·	·	·	·	·	·			
Polystichum retroso-paleaceum	·	+	+	·	·	·	·	1.1	+	·	·	·	·	+	·	·	1.1	·	·	·	·	+				
Differential species of Variant																					
Dryopteris austriaca	2.2	4	4	4	4	4	4	4	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Plectranthus kameba var. *hakusanensis*	1.1	·	+	2	+	2	+	2	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·
Oxalis griffithii	·	1.2	·	+	2.2	2	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Acer palmatum var. *matsumurae*	·	·	·	+	2	·	2.2	+	2	·	3.4	+	2	+	·	+	2.4	2.1	1.1	3.3	·	3.3	3.3	2.2	·		
Tilia japonica	·	·	·	·	·	·	·	1.2	+	2	+	2	1.2	+	2	·	+	+	2	1.1	1.1	+	2	+	2	·	+	2	·	1.1	
Euonymus oxyphyllus	·	·	·	·	·	·	1.1	+	2	1.1	+	2	1.1	+	·	·	+	2	1.1	1.1	+	2	+	2	·	+	1.1	
E. melananthus	·	·	·	·	·	·	·	+	·	·	·	+	+	+	+	2	·	·	+	2	+	2	+	2	·	+	2	
Ilex crenata var. *paludosa*	·	·	·	·	·	·	+	·	·	·	+	2	1.1	1.1	4.4	1.1	3.3	1.1	1.1	+	2	+	2	+	2	·	·	
Carex morrowii var. *temnolepis*	·	·	·	·	·	·	·	·	1.2	·	·	·	·	3.5	1.1	3.3	·	·	2.3	3.3	2.2	2	2.2	2	2.2		
Quercus mongolica var. *grosseserrata*	·	·	·	·	·	·	2.1	·	·	3.3	3.1	1.1	·	3.1	+	3.2	·	2.1	+	·	·	·	·			
Dryopteris sabaei	·	·	·	·	·	·	·	1.1	·	+	2	·	+	·	+	·	·	·	·	+	2	+	2	1.2	1.1		
Clethra barbinervis	·	·	·	·	·	·	·	+	·	·	·	+	+	1.1	+	2	·	·	·	·	+	2	1.2	·		
Viola vaginata	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	1.1	+	·	1.1	·	+	2	+	2		
Differential species of Subvariant																					
Pterocarya rhoifolia	·	1.2	2.1	1.1	2.1	·	+	1.1	1.1	2.2	1.2	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Rumohra standishii	2.2	1.1	·	1.1	·	+	+	2.3	3	·	+	2	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Blechnum niponicum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	2	+	1.2	1.1		
Cornus kousa	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	2	+	2	+	+	
Athyrium otophorum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	2	+	·	·	+	
Hamamelis japonica var. *obtusata*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	2.2	3	1.2	·	·		
Character species of Association																					
Fagus crenata	4.4	5.5	3.3	3.3	5.5	5.5	5.4	5.4	3.3	3.4	4.4	5.5	5.5	5.5	5.5	4.4	2.2	3.3	3.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Acer japonicum	·	2.2	2.2	+	2	+	2	1.2	+	2	1.2	+	2	·	3.3	3.3	3.3	1.1	2.2	1.2	1.2	1.2	1.2	·	·		
Dolichomitriopsis diversiformis	+	2	+	1.2	·	·	+	+	2	+	+	+	+	2	+	+	+	2	+	2	+	2	+	2	+	2	+
Hylocomiopsis ovicarpa	+	2	·	+	1.2	+	2	+	·	+	2	+	1.2	+	2	+	2	+	2	+	2	+	2	+	2	+	2	+
Brachythecium brotheri	+	1.2	+	2	·	+	+	2	+	2	·	+	2	·	1.1	+	+	+	2	·	+	2	·	·	+	2	·	·
B. coreanum	+	2	·	1.2	1.2	+	2	·	+	2	+	·	+	2	+	2	+	·	1.2	·	·	+	·	·	·		
Smilacina japonica	·	1.1	1.1	+	2	+	·	·	+	·	+	·	·	·	·	+	2	1.1	+	·	·	+	2	+			
Acer micranthum	·	·	+	2	·	·	·	+	2	·	·	·	·	+	+	·	·	·	·	·	1.1	·	·			
Paris tetraphylla	·	+	+	+	·	·	·	·	·	·	·	·	·	·	·	1.1	·	+	·	·	·	+	·			
Acer sieboldianum	·	·	·	·	·	·	·	·	+	+	2	1.1	·	·	·	·	·	·	+	·	·	·	·			
Ilex leucoclada	·	+	2	1.1	·	·	·	+	+	2	·	·	·	·	·	·	·	·	·	·	·	·	+			
Brachythecium rhynchostegielloides	+	2	·	·	·	·	·	+	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·			
Magnolia salicifolia	·	1.1	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·			
Goodyera maximowicziana	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·			
Skimmia japonica forma *repens*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·			
Daphniphyllum macropodum var. *humile*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	2	·	·	·			
Transgressive species to the subalpine birch-fir forest																					
Viburnum furcatum	1.1	4.4	3.3	2.2	3.3	2.2	+	2	3.3	·	1.2	+	4.4	1.2	1.1	3.3	3.3	+	2	·	·	1.2	3.3			
Dicranum viride var. *hakkodense*	1.2	+	2	+	1.2	+	2	·	·	+	+	2	+	2	·	+	1.2	+	2	+	2	+	2	·	+	+	+	2
Sasa kurilensis	·	2.2	1.2	2.2	3.3	·	2.3	·	3.3	3.3	·	2.2	+	2	3.3	3.3	2.2	6.5	·	·	·	·	·			
Hylocomium pyrenaicum	·	+	+	+	·	·	+	2	·	·	+	2	1.2	·	+	2	·	+	2	·	·	+	2	·	·	·	
Carex dolichostachya var. *glaberrima*	·	5.5	2.2	5.5	5.5	·	·	·	8.5	6.5	·	·	·	·	·	·	·	·	·	·	·	·	·			
Dolichomitriopsis crenulata	+	·	+	2	+	2	+	2	·	·	+	2	·	·	·	+	·	·	·	·	·	·	·			
Sorbus commixta	·	·	+	·	·	·	·	·	·	·	·	·	·	·	+	·	+	+	+	·	·	·	·			
Callicladium haldanianum	·	+	·	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	+	2	·	·		
Acer tschonoskii	·	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·			
Rhododendron albrechtii	·	·	·	·	·	·	·	·	·	·	·	·	+	2	·	·	·	·	·	·	·	·	·			
Rumohra mutica	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1.1	·	·	·	·	·	·	·	·			
Dicranum scoparium	·	·	·	·	·	·	1.2	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·			

	HA	HD	HD	HD	HD	MS	HC	HD	MS	HC	MS	HA	MS	HE	HE	HE	HC	HC	HC	HC	HD
	46	53	47	51	52	9	41	48	8	43	62	13	42	18	15	14	27	63	64	7	61
Transgressive species from the submontane oak forest																					
Lindera umbellata var. *membranacea*	1.1	+	1.1	·	+	+	2.2	1.1	1.1	·	1.1	+	1.1	r.2	·	r.2	+	1.1	2.2	2.2	2
Schizophragma hydrangeoides	1.1	·	r.2	+	r.2	1.2	r.2	1.1	+	·	r.2	1.1	+	+	r.2	+	r.2	r.2	r.2	·	r.2
Rhus ambigua	+	r.2	r.2	r.2	2.2	+	r.2	2.2	r.2	1.1	+	1.1	1.1	1.1	r.2	1.1	r.2	·	·	·	·
Acer rufinerve	·	1.1	1.2	·	2.2	+	·	r.2	r.2	r.2	+	·	+	r.2	·	·	r.2	·	r.2	1.1	·
Prunus grayana	+	·	1.1	·	+	+	+	·	r.2	+	·	·	·	·	r.2	1.1	·	·	·	r.2	·
Rhus trichocarpa	·	1.1	+	·	·	·	r.2	·	·	·	·	·	+	·	·	·	·	·	·	+	+
Aucuba japonica var. *borealis*	·	·	r.2	·	1.1	·	·	1.1	·	·	r.2	·	·	·	·	·	2.2	·	·	·	·
Disporum smilacinum	·	·	2.2	r.2	·	·	·	·	·	·	·	·	·	·	r.2	r.2	·	·	·	·	·
Sorbus alnifolia	·	·	·	·	·	·	·	·	·	·	·	·	+	·	r.2	·	·	·	r.2	·	+
Vaccinium japonicum	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	r.2
Moisture elements																					
Cephalotaxus harringtonia var. *nana*	1.1	·	r.2	1.1	2.2	4.4	3.3	3.3	3.4	4.4	3.3	2.2	1.1	3.3	2.2	1.2	2.2	3.3	2.2	r.2	2.2
Acer mono	·	1.1	2.2	·	·	1.1	2.1	1.1	+	r.2	3.3	r.2	·	1.1	1.1	2.1	r.2	+	r.2	+	2.2
Thamnobryum alopecurum	+	·	+	r.2	+	+	·	r.2	+	·	r.2	r.2	·	r.2	+	·	r.2	r.2	+	+	·
Hydrangea petiolaris	·	r.2	+	+	·	·	1.1	r.2	+	r.2	·	·	·	+	·	+	r.2	r.2	+	·	+
Euonymus alatus forma *dentatus*	·	·	1.1	·	·	+	r.2	1.1	r.2	r.2	+	+	·	·	1.1	r.1	+	·	·	·	r.
Companions																					
Thuidium kanedae	r.2	r.2	·	·	·	r.2	r.2	r.2	r.2	r.2	r.2	r.2	r.2	r.2	r.2	r.2	r.2	+	r.2	r.2	+
Fissidens cristatus	r.2	+	·	·	·	r.2	·	r.2	r.2	·	·	r.2	r.2	·	+	+	·	+	+	+	r.2
Fauriella tenuis	r.2	·	+	+	r.2	r.2	r.2	+	r.2	·	r.2	+	+	+	·	+	+	r.2	r.2	r.2	·
Brachythecium populeum	·	r.2	r.2	+	r.2	r.2	r.2	+	+	·	r.2	·	·	+	r.2	+	·	+	r.2	r.2	+
Corylus sieboldiana	·	·	1.2	3.3	2.2	+	r.2	·	·	r.2	+	·	·	·	r.2	1.1	+	r.2	r.2	·	+
Cornus controversa																					
Acanthopanax sciadophylloides	·	+	·	1.1	·	·	·	·	·	·	·	·	+	·	·	·	+	+	·	1.2	r.2
Peracarpa carnosa var. *circaeoides*	·	·	·	1.2	r.2	·	·	·	·	+	·	·	·	+	r.2	+	·	·	·	·	·
Athyrium squamigerum	·	·	·	+	·	·	+	+	·	·	·	1.2	·	+	·	+	·	·	·	·	·
Vitis coignetiae	+	·	·	1.2	r.2	·	+	·	·	·	·	·	·	·	·	·	·	·	·	+	·
Disporum sessile	·	1.2	r.2	·	1.1	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	·
Rodgersia podophylla	·	+	r.2	r.2	·	·	1.1	·	·	·	·	·	·	+	·	·	·	·	·	·	·
Panax japonicus	·	·	+	·	·	·	·	·	+	·	·	·	·	·	+	+	+	·	·	·	·
Actinidia arguta	·	·	·	·	·	·	+	+	+	·	·	+	·	·	·	·	·	·	·	·	·
Rhynchostegium pallidifolium	·	·	·	·	·	·	+	+	·	·	·	+	·	·	·	·	+	·	·	·	·
Athyrium wardii var. *majus*	·	·	·	·	·	+	+	·	·	·	+	·	·	·	·	·	·	·	·	+	·
Alangium platanifolium var. *trilobum*	·	·	·	·	·	·	+	1.1	+	·	+	·	·	·	·	·	·	·	·	·	·
Dicranum nipponense	·	·	·	·	·	·	·	·	r.2	·	r.2	·	r.2	·	·	+	·	·	·	·	·
Rumohra miquoliana	·	·	·	·	·	·	·	·	·	·	·	+	·	+	·	·	·	·	·	r.2	1.2
Thuidium bipinnatulum	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	+	·	·	·
Carex foliosissima	·	·	·	·	·	3.3	·	·	1.1	·	1.2	·	·	·	·	·	·	·	·	·	·
Ulmus laciniata	·	·	·	·	·	·	+	·	r.2	+	·	·	·	·	+	·	1.2	·	·	·	·
Torreya nucifera var. *radicans*	·	·	·	·	·	·	·	·	·	·	2.2	·	·	·	·	·	·	1.2	·	·	+
Kalopanax pictus	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	+	·	·	·	r.2	·
Euonymus sieboldiana	+	·	·	·	·	·	+	·	·	·	·	·	·	·	·	+	·	·	·	·	·
Helwingia japonica	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	1.1	·	+	·	·
Betula grossa	·	·	·	·	·	3.2	·	·	1.1	·	2.1	·	·	·	·	·	·	·	·	·	·
Hydrangea paniculata	·	·	r.2	·	·	·	·	·	·	·	·	·	r.2	·	·	·	+	·	·	·	·
Euonymus fortunei	·	·	·	·	·	·	·	+	·	+	·	·	·	·	·	·	+	·	·	·	·
Celastrus orbiculatus	·	·	·	·	+	·	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·
Plagiothecium euryphyllum	·	·	·	·	·	+	·	·	·	·	·	+	·	·	·	r.2	·	·	·	·	·
Lastrea nipponica	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+
Hypnum tristo-viride	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	+	·	·
Rubus hakonensis	·	·	·	·	·	·	·	1.2	2.2	·	·	·	·	·	·	·	·	·	·	·	·
Alnus hirsuta var. *sibirica*	·	·	·	·	·	2.1	·	·	·	·	·	·	·	·	·	·	·	2.1	·	·	·
Sambucus sieboldiana	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	·	·	·
Oplopanax japonicus	·	1.1	1.2	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Osmunda asiatica	·	·	·	·	·	·	r.2	·	·	+	·	·	·	·	·	·	·	·	·	·	·
Bryhnia novae-angliae	·	·	·	·	·	·	+	·	·	·	·	+	·	·	·	·	·	·	·	·	·
Philadelphus satsumi	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	2.2	·	·	+	
Dicranum flagellare	·	·	·	·	·	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·	·
Ainsliaea acerifolia var. *subapoda*	·	r.2	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	3.3
Actaea asiatica	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	+
Asperula odorata	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	r.2	·	·	·
Pertya rigidula	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	+
Trillium smallii	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	·
Homalia japonica	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·
Ctenidium pulchellum	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·
Plagiothecium nomolare	·	·	·	·	·	+	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·
Cacalia adenostyloides	·	r.2	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·
Brachythecium buchananii	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Plagiomnium trichomanes	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·
Hypnum erectiusculum	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·
H. fauriei	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·
Weigela hortensis	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Laportea bulbifera	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·
Cacalia nikomontana	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Melliosma tenuis	·	·	·	·	·	·	·	1.1	·	·	·	·	·	·	·	·	·	·	·	·	·
Chloranthus japonicus	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·
Gastrodia elata	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Clematis japonica forma *prupureo-fusca*	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Smilax nipponica	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Pyrola japonica	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Streptopus streptopoides var. *japonicus*	1.1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Ardisia japonica	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	r.2	·	·	·	·
Dioscorea tokoro	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Anomodon rugelii var. *rugelii*	·	·	·	·	·	r.2	·	·	·	+	·	+	·	·	·	·	·	·	·	·	·
Callicarpa japonica	·	·	·	·	·	·	·	·	1.1	·	·	·	·	·	·	·	·	·	·	·	·
Viburnum wrightii	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·
Cercidiphyllum japonicum	·	·	·	·	·	·	·	2.1	·	·	·	·	·	·	·	·	·	·	·	·	·
Styrax obassia	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·
Myuroclada maximowiczii	·	·	·	·	·	r.2	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Dropanocladus uncinatus	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Atricum undulatum	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·
Polygonatum lasianthum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+
Stachyurus praecox	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+
Matteuccia struthiopteris	·	·	·	·	·	·	·	·	·	·	·	·	·	·	2.2	·	·	·	·	·	·

differential species mentioned above. The canopy dominated by *Fagus crenata* is commonly accompanied by *Aesculus turbinata* or *Pterocarya rhoifolia*.

In floristic composition this forest is similar to the Polysticho-Pterocaryetum

Suz.-Tok. (1955) and Pterocaryion rhoifoliae Miyawaki et al. (1964). It differs, however, in the fact that the forest includes many character- and constituent species of the beech forest. Moreover, *Ligustrum tschonoskii* and *Euonymus melananthus* occurring here are not found in the Polysticho-Pterocaryetum. Consequently this forest should be included in the scope of the beech forest. The Aesculetosum was originally reported by T. Suzuki (1952) under the Saso kurilensis-Fagetum crenatae. According to him, it is widely distributed from Tohoku to Kanto regions. Later, Usui (1955) described it with a synthesis table from Yunishikawa, Kanto region. The forest on Mt. Hakusan is similar in floristic composition to that described by Usui. The writer has considered this forest to deserve a subassociation under the Lindero membranaceae-Fagetum crenatae, although Sasaki (1970) ignored this type in his new classification of the beech forest of Japan.

The undergrowth is characterized by the luxuriant growth in both fern and sedge layers. *Cepahlotaxus harringtonia* var. *nana* and *Sasa kurilensis* usually make the upper shrub layer.

In this subassociation, the following two variants and three subvariants are recognized.

B-1. *Dryopteris austriaca* variant

Differential species: *Dryopteris austriaca, Plectranthus kameba* var. *hakusanensis, Oxalis griffithii.*

As this variant develops on gentle slopes or in slight depressions, ecologically and physiognomically it is more or less similar to the Dryopteridetosum shown later. There is, however, a distinct difference between the two, namely, this variant is almost lacking *Magnolia salicifolia, Skimmia japonica* forma *repens, Ilex leucoclada, I. crenata* var. *paludosa, Maianthemum dilatatum* and *Rumohra mutica* which occur in the latter subassociation. Furthermore, this subassociation includes the differential species cited above.

The fern layer is dominated by *Dryopteris austriaca* and *D. crassirhizoma,* and the sedge layer is predominated by *Carex dolichostachya* var. *glaberrima.*

B-2. *Acer palmatum* var. *matsumurae* variant

Differential species: *Acer palmatum* var. *matsumurae, Tilia japonica, Euonymus oxyphyllus, E. melananthus, Ilex crenata* var. *paludosa, Carex morrowii* var. *temnolepis, Quercus mongolica* var. *grosseserrata, Dryopteris sabaei, Clethra barbinervis, Viola vaginata.*

This variant is found on the lower part of steep slopes and flat parts along the rivulet of the valley bottoms. In the habitat conditions, it is more or less related to the Polysticho-Pterocaryetum, but the soil is much drier than in the latter. Abundant occurrence of *Clethra barbinervis* and *Carex morrowii* var. *temnolepis* suggests a slightly dry soil condition. The drainage is far better than

in the preceding variant.

B-2-a. *Pterocarya rhoifolia* subvariant

Differential species: *Pterocarya rhoifolia, Rumohra standishii.*

This unit occurs on somewhat similar site to the *Dryopteris austriaca* variant. In this subvariant, *Euonymus melananthus, Ilex crenata* var. *paludosa, Carex morrowii* var. *temnolepis* and *Clethra barbinervis* are more weakly represented. On the other hand, the differential species of this subvariant, except *Alangium platanifolium* var. *trilobum,* are common to this and the preceding *Dryopteris austriaca* variant.

B-2-b. Typical subvariant

This lacks the differential species and occurs mainly on stony ground of the valley bottom. *Ilex crenata* var. *paludosa* is prominent in the lower shrub layer, but *Polystichum tripteron, P. retroso-paleaceum* and *Euonymus oxyphyllus* are weakly represented. These two facts form a marked difference from the other subvariants.

B-2-c. *Cornus kousa* subvariant

Differential species: *Cornus kousa, Athyrium otophorum, Hamamelis japonica* var. *obtusata.*

It develops on the middle part of steep slopes where the soil is well drained, and is distinguished from the preceding by the marked occurrence of the above-cited differential species. Occurrence of these species seems to indicate a somewhat drier condition of habitat.

C. Subass. pinetosum nov. (Table 5)

Syn. *Pinus parviflora–Fagus crenata* forest Suz.-Tok. & Hukusima 1972, Hukusima 1975, Ann. Rep. Hakusan Nature Conservation Center 1: 28, Table 1 (19 records from Mt. Hakusan).

Differential species: *Pinus parviflora, Epigaea asiatica, Brotherella henonii, Thuja standishii, Gaultheria adenothrix.*

Altitudinal range: 750–1610 m.

Number of component species: 34 (27–48).

The physiognomy of this forest is characterized by the remarkable luxuriance of *Pinus parviflora* in the forest canopy. Distribution of this forest is determined by the topographical condition. In the eastern and the northern part of Mt. Hakusan which consist of Nôhi Rhyolite, this forest is found widely forming patches. Its distributional area is contrastive to that of the subassociation, Cryptomerietosum later cited. Its occurrence is restricted to rugged summits and the upper part of steep slopes with intense insolation and strong wind blowing, which result in light snowdrifts and oligotrophic drier soil.

Table 5. Pinetosum

1. *Sasa kurilensis* variant: a. Typical subvariant, b. *Plagiogyria matsumureana* subvariant; 2. *Lyonia ovalifolia* var. *elliptica* variant: a. *Chamaecyparis obtusa* subvariant, b. Typical subvariant

| Variant | 1 | | |

	HC 71	HC 6	HC 66	HC 83	HC 70	HC 78	HC 11	HD 58	HC 62	HB 61	HB 5	HA 23	HC 24	HC 5	HC 40	HC 3	HC 13	HC 4	HC 11	HC 2	MS 55	MS 54	HC 12
Transgressive species from the submontane oak forest																							
Hamamelis japonica var. *obtusata*	4	4	3.4	4.4	3.3	4.4	3.3	3.3	+	2.2	2.2	3.3	2.3	3.4	3.3	1.1	2.2	1.2	3.3	2.2	2.3	2.2	1.1
Vaccinium japonicum	3.3	2.3	+.2	1.2	2.2	2.2	2.2	1.2	+	2.2	1.1	·	2.3	3.3	3.3	1.1	2.2	1.2	2.3	2.2	2.4	4.2	2.3
Clethra barbinervis	2.2	3.3	1.2	·	2.2	+.2	1.2	2.3	3.3	2.2	+	+.2	2.2	2.3	3.3	2.2	2.2	3.3	+.2	3.3	+	2.2	1.2
Rhus trichocarpa	+.2	+.2	·	+.2	+.2	1.1	1.1	1.1	+.2	+.2	1.1	1.1	1.2	1.1	+	+	+	+.2	1.1	+.2	1.1	1.1	+
Mitchella undulata	1.1	2.2	·	·	1.2	1.1	·	·	·	1.1	·	2.2	2.2	·	1.1	3.3	+.2	1.1	·	2.2	+.2	2.2	·
Sorbus alnifolia	+	·	1.2	1.2	1.2	+	+	·	+	·	·	·	·	·	·	+.2	+	1.2	2.3	+.2	1.1	1.1	2.2
Quercus mongolica var. *grosseserrata*	1.1	·	2.2	3.3	1.2	·	+.2	·	·	·	·	·	·	·	1.2	2.2	2.2	3.1	·	·	2.1	1.1	2.1
Blechnum niponicum	·	+	+	·	+.2	+	·	·	+.2	+	1.2	2.2	+	·	+	1.2	·	·	·	·	·	·	·
Lindera umbellata var. *membranacea*	·	·	+	·	·	+.2	+.2	1.1	+	+	+	+	+.2	·	·	+	·	·	+	·	1.1	·	+
Ilex crenata var. *paludosa*	+.2	·	+.2	·	+	+.2	+	·	+.2	+.2	·	+.2	·	·	·	·	·	·	·	·	·	+	·
Prunus grayana	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	+	·	·	+	·	·
Disporum smilacinum	+.2	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1.1	+	·
Symplocos paniculata	·	·	·	·	·	+	1.2	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·
Schizophragma hydrangeoides	·	3.3	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·
Acer rufinerve	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·
Moisture elements																							
Cephalotaxus harringtonia var. *nana*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·
Euonymus oxyphyllus	·	·	+	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·
Thamnobryum alopecurum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·
Dryopteris sabaei	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·
Dry elements																							
Tripetalcia paniculata	3.3	3.3	2.2	4.4	3.3	+	4.4	·	2.2	+.2	3.3	4.4	3.3	3.3	3.3	2.3	3.3	3.3	3.3	+.2	+	+	3.3
Ilex sugerokii var. *brevipedunculata*	2.2	1.2	3.3	1.2	3.3	1.2	1.2	1.2	·	+.2	3.3	2.2	1.1	2.2	2.2	1.2	2.3	+.2	+.2	1.2	·	·	2.2
Rhododendron nudipes	1.2	+.2	1.2	+.2	3.3	·	1.1	·	·	·	2.2	+.2	1.1	+	+.2	+.2	1.2	·	1.2	1.2	2.2	1.1	1.2
Leucobryum neilgherrense	·	+	·	·	+.2	·	+	+.2	+	+	+	+.2	+.2	+	+	+	·	+	+	+	+	+	+
Menziesia multiflora	1.2	·	·	+.2	+.2	1.2	·	+.2	+.2	+.2	·	·	+.2	1.1	·	+	·	+.2	·	·	·	·	+.2
Rhododendron kaempferi	1.2	+.2	·	·	1.2	·	+.2	·	·	·	1.2	·	·	·	·	·	+	·	+.2	·	1.2	·	+
Shortia uniflora	·	·	·	·	·	·	·	4.4	5.5	4.4	·	5.5	5.5	·	·	5.5	·	4.4	3.4	4.5	·	·	·
Heloniopsis orientalis	+.2	·	·	·	+.2	·	·	·	·	+	+	+.2	·	·	·	·	·	·	·	·	·	·	·
Companions																							
Thuidium kanodae	+.2	+.2	+	+	+	+.2	+	·	·	+	1.2	+.2	+.2	·	+.2	+	+.2	+	+.2	+	1.2	+.2	+
Pauriella tonuis	+.2	+.2	+.2	+.2	+.2	+	+	+	+	+	+	+	+.2	+	+	+	1.2	+	+.2	+.2	·	+	+.2
Leucothoe grayana var. *oblongifolia*	1.1	+.2	+	1.1	1.1	1.1	1.1	·	+.2	·	·	·	+	+	·	·	+	·	·	·	·	·	·
Dicranum nipponense	·	·	·	·	·	·	·	·	+.2	+	+	·	·	·	·	·	·	+	·	·	·	·	·
Evodiopanax innovans	·	+	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	2.2	+	·
Rhytidiadelphus japonicus	·	·	·	·	·	·	·	·	·	·	+.2	+	·	·	·	+	1.2	·	·	·	·	·	·
Shortia soldanelloides	·	·	3.3	·	·	·	·	·	·	·	2.2	·	·	·	+.2	·	·	·	·	·	·	·	·
Rhododendron brachycarpum	+.2	·	2.2	·	·	·	+.2	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Alnus hirsuta var. *sibirica*	·	2.1	·	·	·	·	·	·	2.1	·	·	·	·	2.1	·	·	·	·	·	·	·	·	·
Acer distylum	·	·	·	·	·	·	·	·	·	·	·	1.2	·	·	+.2	·	·	1.2	·	·	·	·	·
Viburnum wrightii	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+.2	·	1.1	+	·	·	·
Solidago virga-aurea var. *asiatica*	·	·	·	·	·	·	·	·	·	·	+.2	·	·	·	·	·	·	·	+	·	·	·	·
Stacyurus praecox	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	+
Hypnum oldhamii	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	·	+.2
Betula grossa	·	·	·	·	·	·	·	·	·	·	·	2.1	·	·	·	·	1.1	·	·	·	·	·	·
Carpinus laxiflora	·	·	·	·	·	·	·	·	·	·	·	+.2	·	·	·	+.2	·	·	·	·	·	·	·
Wisteria floribunda	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1.2	+.2	·	·	·
Acer crataegifolium	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+.2	+	·	·	·
Styrax obassia	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	+	·
Torreya nucifera var. *radicans*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·
Kalopanax pictus	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·
Plagiothecium euryphyllum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·
Brachythecium populeum	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Cornus kousa	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·
Carpinus japonica	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·
Pogonatum japonicum	·	·	·	·	·	·	·	·	·	·	+.2	·	·	·	·	·	·	·	·	·	·	·	·
Taxus cuspidata	·	·	·	·	·	·	·	·	·	·	1.2	·	·	·	·	·	·	·	·	·	·	·	·
Tripterospermum japonicum	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·
Euonymus melananthus	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·
Vaccinium hirtum	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·
Hydrangea paniculata	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·
Polygonatum lasianthum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+
Sorbus japonica	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1.2	·	·	·	·
Vaccinium oldhamii	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+
Tsuga diversifolia	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+.2	·	·	·	·	·	·	·	·
Enkianthus campanulatus	·	·	·	·	·	·	·	1.1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Viburnum urceolatum var. *procumbens*	·	·	·	·	·	·	·	·	·	·	+.2	·	·	·	·	·	·	·	·	·	·	·	·
Polysticum formosum	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·
Pleurozium schreberi	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Castanea crenata	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·
Anomodon rugelii var. *rugelii*	·	·	·	·	·	·	·	·	·	·	+.2	·	·	·	·	·	·	·	·	·	·	·	·

Floristically, this forest is characterized by the occurrence of several heliophilous and xerophilous plants of the Rhodoreto-Thujetum Usui 1955, Pinion pentaphyllae Suz.-Tok. 1966 in Mt. Hakusan. Furthermore, this forest is

characterized by the luxuriant growth of both the transgressive species from the submontane oak forest and the species of the dry soil elements. On the other hand, the character species of the beech forest, such as *Ilex leucoclada, Smilacina japonica, Carex morrowii* var. *temnolepis, Paris tetraphylla, Goodyera maximowicziana* and *Brachythecium brotheri* are lacking or rare here. This forest is distinguished from the Rhodoreto-Thujetum by the high presence and dominance of other character and prominent constituents of the beech forest. It, therefore, should be treated as a new subassociation, pinetosum. As the type stand for this subassociation was selected a *Fagus crenata–Hamamelis japonica* var. *obtusata–Tripetaleia paniculata–Epigaea asiatica* sociation on HC 71 in Table 5 at Mt. Sanpoiwadake, Gifu Prefecture.

Stratification of this subassociation is characterized by a combination of the coniferous tree layer of *Pinus parviflora, Thuja standishii* and *Chamaecyparis obtusa* and the ericaceous shrub layer, and hence it closely resembles the Rhodoreto-Thujetum. The shrub layer is well-developed and two-storied: the upper dominated by *Tripetaleia paniculata* and *Rhododendron nudipes* accompanied by *Ilex sugerokii* var. *brevipedunculata* and the lower dominated by *Vaccinium japonicum.* However, the herb layer is poor: the fern layer is generally lacking and the sedge layer is replaced by *Shortia uniflora* and *Epigaea asiatica.* In the moss layer, heliophilous and xerophilous species such as *Brotherella henonii* and *Leucobryum neilgherrense* are prominent.

This subassociation is subdivided into two variants: variant of *Sasa kurilensis* and that of *Lyonia ovalifolia* var. *elliptica* which are segregated altitudinally, the former being located at higher elevations than the latter.

C-1. *Sasa kurilensis* variant

Differential species: *Sasa kurilensis, Rhododendron albrechtii, Acanthopanax sciadophylloides, Brachythecium rhynchostegielloides, Hylocomiopsis ovicarpa.*

With regard to ecological aspects, there is no remarkable difference between the present and the next variants. However, the present variant includes more hygrophilous plants than the latter.

This includes two subvariants.

C-1-a. Typical subvariant

Although the differential species is lacking for this subvariant, species such as *Pinus parviflora, Epigaea asiatica, Leucothoe grayana* var. *oblongifolia* and *Ilex crenata* var. *paludosa* show better growth than in the next subvariant. The rich occurrence of these species indicates an ecological affinity to the Rhodoreto-Thujetum. In the lower herb layer, *Epigaea asiatica* is dominant instead of *Shortia uniflora.*

C-1-b. *Plagiogyria matsumureana* subvariant

Differential species: *Plagiogyria matsumureana, Rumohra mutica.*

This subvariant is characterized by the above two ferns which are common to the beech and the birch-fir forests. *Sasa kurilensis* and *Rhododendron albrechtii* are usually abundant, while *Rhododendron nudipes, R. kaempferi* and *Epigaea asiatica,* indicating drier habitats, grow less vigorously. Judged from these features, the habitat of this subvariant is slightly wetter than the preceding one. Therefore, the density and dominance of the plants in the undergrowth are greater than in any other variants or subvariants of this subassociation. The upper shrub layer is dominated by *Sasa kurilensis* and *Tripetaleia paniculata,* and the lower by *Vaccinium japonicum.* The upper herb layer is dominated by two differential ferns, but they are not exclusive as in the other subassociations. The lower herb layer is well dominated by a creeping evergreen rosette plant, *Shortia uniflora.*

C-2. *Lyonia ovalifolia* var. *elliptica* variant

Differential species: *Lyonia ovalifolia* var. *elliptica, Sorbus gracilis, Ilex pedunculosa, Fraxinus lanuginosa.*

This variant seems to usually appear dominating on dry soils of steep mountain ridges and the middle part of steep slopes at lower elevations in this area. In addition to the differential species mentioned above, *Brotherella henonii* and *Clethra barbinervis* are noticeable plants indicating drier habitat condition. Furthermore, this variant includes some of the character species of the oak forest, such as *Carpinus laxiflora, Castanea crenata, Acer crataegifolium, Styrax obassia, Wisteria brachybotrys* and *Cornus kousa,* though their presence and dominance are generally low.

This variant includes two subvariants.

C-2-a. *Chamaecyparis obtusa* subvariant

Differential species: *Chamaecyparis obtusa, Hypnum tristo-viride.*

Occurrence of this subvariant is restricted to the middle part of steep slopes where the habitat seems slightly wetter than in the next subvariant. This fact is indicated also by occasional occurrences of *Plagiogyria matsumureana* and *Rumohra mutica.*

C-2-b. Typical subvariant

This is characterized only by the essential components of the variant, but *Acer japonicum* and *Sorbus alnifolia* occur with higher presence and greater coverage than in the preceding subvariant. It develops exclusively on steep ridges.

D. Subass. cryptomerietosum nov. (Table 6)

Differential species: *Cryptomeria japonica, Viburnum urceolatum* var. *procumbens, Hypnum tristo-viride.*

Altitudinal range: 1020–1375 m.

Number of component species: 38 (25–50).

This forest is widely distributed in the western part of Mt. Hakusan, covering altitudinally the middle part of the beech forest zone. Its occurrence is related to the kind of bed-rock of the Tedori Group, which has been weathered into heavy clay soil and resulted in a formation of even ridge lines and gentler slopes, where the snow accumulates heavily and remains late.

Floristically, this forest is characterized by the three differential species mentioned above. *Hypnum tristo-viride,* however, has somewhat different nature among them, it is one of the differential species of *Chamaecyparis obtusa* subvariant of the Pinetosum. This is probably due to the fact that the bark of conifer-trees is more acid than that of deciduous broad-leaved trees as pointed out by Ando (1966). The coexistence of this moss and the other two vascular species in this forest is rather constant, and therefore, they form excellent differential species of the forest. Many character species of the mother association occur with higher presence and greater dominance. On the other hand, such species as *Viburnum furcatum, Sasa kurilensis, Plagiogyria matsumureana* and *Rumohra mutica,* which are common with the subalpine forest, grow well. Hence, this forest should be treated as a new subassociation, cryptomerietosum. As a type stand for this subassociation, a *Fagus crenata–Clethra barbinervis–Sasa kurilensis–Viburnum urceolatum* var. *procumbens–Rumohra mutica–Shortia uniflora* socition on HD 24 in Table 6 at Ohsugidani, Ishikawa Prefecture, was selected. Forests with similar physiognomy are widely distributed on the Chugoku mountains in southwestern Honshu (Sasaki 1957, 1964; Nakanishi et al. 1970; Shimizu & Ochi 1974), but they belong to another association, Lindero umbellatae-Fagetum crenatae Sasaki 1970.

The upper shrub layer of this subassociation is generally dominated by *Sasa kurilensis,* and in somewhat dry sites, *Rhododendron metternichii* var. *hondoense, R. nudipes* and *Tripetaleia paniculata* become prominent. *Ilex leucoclada, Skimmia japonica* forma *repens* and *Vaccinium japonicum* are dominantly intermingled in the lower shrub layer. The herb layers, both upper and lower, are well developed; in the upper layer *Plagiogyria matsumureana* and *Rumohra mutica* occur with higher presence and greater dominance, the lower is occupied by *Shortia uniflora* accompanied by *Carex morrowii* var. *temnolepis,* with high presence, and occasionally associated with *Cornus canadensis* and *Maianthemum dilatatum* in some sites.

This includes the following two variants.

D-1. *Mitchella undulata* variant

Differential species: *Mitchella undulata, Hylocomiopsis ovicarpa, Schizophragma hydrangeoides, Acer sieboldianum, Rhus ambigua.*

The habitat of this variant is not uniform. It develops on flat ridges or the upper or middle part of gentle slopes. It is widely distributed in this area and forms the main part of the subassociation. In addition to the differential species

mentioned above, *Ilex leucoclada, Daphniphyllum macropodum* var. *humile, Carex morrowii* var. *temnolepis, Lindera umbellata* var. *membranacea, Prunus grayana* and *Aucuba japonica* var. *borealis* show highr presence and dominance in this variant than in the next.

This includes three subvariants which are associated with their respective special habitats.

D-1-a. *Cornus canadensis* subvariant

Differential species: *Cornus canadensis.*

This is restricted to flat sites on ridges or slopes, often surrounding the moor, where snow accumulates heavily. The rich gowth of *Cornus canadensis*, which is one of the character species of the Abietum mariesii Suz.-Tok. 1954, in the lower herb layer is remarkable. *Sasa kurilensis* and *Acer tschonoskii* are more remarkable than in any other subdivision of the subassociation. *Ilex sugerokii* var. *brevipedunculata* is almost constant. The habitat condition seems similar to that of the subalpine forest.

D-1-b. Typical subvariant

This has no diagnositc species, but it is characterized by the nuclear species of the mother variant. It occurs on the middle and lower parts of slopes. *Ilex crenata* var. *paludosa, Dicranum scoparium* and *Hypnum fujiyamae* are represented weakly, but *Maianthemum dilatatum* grows luxuriantly.

D-1-c. *Tripetaleia paniculata* subvariant

Differential species: *Tripetaleia paniculata, Rhododendron albrechtii, Menziesia multiflora, Heloniopsis orientalis, Coptis japonica.*

This occurs on ridges and the upper part of slopes. As the above-mentioned differential species sometimes occur also in the next variant, the floristic composition is similar to the latter. It is, however, distinguished by the constant occurrence of the differential species of the mother variant. The forest seems to be somewhat more xerophilous and heliophilous than the other subvariants. The differential species except *Coptis japonica* are mostly indicators of drier soil condition. *Coptis japonica* is confined to this subassociation in the beech forest, playing a role of the most effective differential species. The upper shrub layer is characterized by the luxuriant growth of ericaceous plants such as *Tripetaleia paniculata, Rhododendron nudipes* and *Menziesia multiflora.* The lower shrub layer is sometimes lacking.

D-2. *Rhododendron metternichii* var. *hondoense* variant

Differential species: *Rhododendron metternichii* var. *hondoense.*

This is easily recognized by the luxuriant growth of the differential species. It develops in two different habitats, namely, on roundish ridges where this

variant develops always in contact with the preceding variant, and at the margin of the moor. The density and dominance of the plants in the undergrowth, except *Rhododendron metternichii* var. *hondoense*, become lesser than in any other communities of the same subassociation. The undergrowth is characterized by the luxuriant growth of *Rhododendron metternichii* var. *hondoense* in the upper shrub layer, and in many cases the lower shrub layer is lacking.

E. Typical subassociation (Sasaki 1970) emend. (Table 7)

Syn. Lindero membranaceae-Fagetum crenatae, *Carex morrowii* var. *temnolepis* subassociation Sasaki 1970, Vegetatio 20: 223, Table 1 (30 records).

Altitudinal range: 880–1600 m.

Number of component speices: 39 (24–54).

Sasaki (1970) reported four subassociations under the Lindero membranaceae-Fagetum crenatae: *Camellia rusticana-*, *Dryopteris austriaca-*, Typical and *Carex morrowii* var. *temnolepis* subassociations. He discussed their distributions. Of the four, the former two are found in Mt. Hakusan. According to Sasaki (1970), *Carex morrowii* var. *temnolepis* subassociation was distinguished from the Typical subassociation by the occurrence of *Carex morrowii* var. *temnolepis*, and Mt. Hakusan is situated within a range of these two subassociations. In Mt. Hakusan, however, the stands containing *Carex morrowii* var. *temnolepis* are found in most parts of the beech forest, and this species proves to be a character species of the beech forest of Mt. Hakusan. It is therefore no meaning to distinguish the two subassociations, *Carex morrowii* var. *temnolepis-* and the Typical, by this sedge. Consequently, these two should be united into the Typical subassociation for the beech forest of Mt. Hakusan. Although the Typical subassociation includes the *Shortia uniflora* variant with many differential species in Sasaki's system, the variant should be separated from this subassociation, and placed in the next subassociation, Tripetaleietosum.

This subassociation is found on gentle slopes at every altitude of the whole area, and forms the main part of the association in Mt. Hakusan. This has no diagnostic species in particular, but most of the character spcies of the association occur in high frequence and abundance.

The undergrowth is well developed, and shows the most typical stratification of four layers. *Sasa kurilensis* and *Lindera umbellata* var. *membranacea* are codominant in the upper shrub layer. In the lower shrub layer, *Ilex leucoclada, Skimmia japonica* forma *repens* and *Daphniphyllum macropodum* var. *humile* become prominent accompanied by *Vaccinium japonicum*. The herb layer is two-storied. The upper is dominated by *Plagiogyria matsumureana* and *Rumohra mutica*. In some stands of the middle part of steep slopes, *Ainsliaea acerifolia* var. *subapoda* is remarkable. The lower herb layer is mostly covered with *Carex morrowii* var. *temnolepis*. In some places, *Disporum smilacinum* and *Mitchella undulata* occur in high presence.

This subassociation includes the following two variants and four subvariants corresponding to the difference of habitats and altitudinal ranges.

E-1. Typical variant

This variant usually appears dominantly on flat ridges and the upper part of gentle slopes at medium altitudes. Sometimes it contacts with the subassociation Dryopteridetosum shown later. Although the floristic feature is poor, *Sasa kurilensis, Acer tschoskii* and *Skimmia japonica* forma *repens* grow more luxuriantly than in the next variant.

E-1-a. Typical subvariant

The altitudinal range and habitat condition of this subvariant are variable. Its distribution is rather small, and its floristic composition and characteristics habitat are related to those of the next subvariant. The most conspicuous features are reduction of *Carex morrowii* var. *temnolepis* and luxuriant growth of *Daphniphyllum macropodum* var. *humile*, etc. This subvariant most closely resembles the Typical subassociation described by Sasaki (1970).

E-1-b. *Maianthemum dilatatum* subvariant

Differential species: *Maianthemum dilatatum, Rhododendron albrechtii, Clintonia udensis, Menziesia pentandra.*

This is usually found at higher altitudes than the former. This subvariant sometimes includes *Betula ermanii* which is one of the character species of the Abietum mariesii in Mt. Hakusan. With regard to the ecological and floristical features, it shows a similarity to the birch-fir forest.

E-2. *Acer mono* variant

Differential species: *Acer mono, Blechnum niponicum, Cephalotaxus harringtonia* var. *nana, Fraxinus lanuginosa, Ainsliaea acerifolia* var. *subapoda.*

This occupies the large part of the gentle slopes. On the upper part of the slopes, it comes in frequent contact with the Tripetaleietosum shown later. It usually occurs on the drier soil than the former, and shows rich growth of *Hamamelis japonica* var. *obtusata, Clethra barbinervis* and *Sorbus alnifolia.* The upper herb layer is usually poor in coverage.

E-2-a. Typical subvariant

Its best development is seen in the middle part of steep slopes, and its total area is much smaller than that of the next. Near the upper part of slopes, it comes in contact with *Maianthemum dilatatum* subvariant, and differential species of that subvariant penetrate into this in the higher sites. It is, however, distinguished from the latter by the difference of habitat and other floristic components.

E-2-b. *Acer palmatum* var. *matsumurae* subvariant

Differential species: *Acer palmatum* var. *matsumurae, Euonymus alatus* forma *ciliatodentatus, Kalopanax pictus, Dryopteris sabaei, Hydrangea petiolaris, Quercus mongolica* var. *grosseserrata, Euonymus oxyphyllus, Tilia japonica.*

This is extensively spread throughout the lower area of the beech forest, and its habitats are variable. Although it frequently neighbors the preceding typical subvariant, this subvariant differ distinctly in having the above-mentioned differential species. Some of these species grow also in the Aesculetosum with high presence and dominance, and suggest the similarity of habitat conditions between them. *Cornus kousa, Aucuba japonica* var. *borealis, Corylus sieboldiana, Hydrangea paniculata, Hypnum fujiyamae* and *Euonymus sieboldiana* occur in somewhat high presence in this subvariant. The upper shrub layer is usually closed with *Cephalotaxus harringtonia* var. *nana.*

F. Subass. tripetaleietosum nov. (Table 8)

Differential species: *Tripetaleia paniculata, Rhododendron nudipes, R. kaempferi, Shortia uniflora.*

Altitudinal range: 960–1410 m.

Number of component species: 38 (29–49).

The above-mentioned differential species show high presence in both the shrub and herb layers, but the rate of their mixture varies with habitat and altitude. They serve to separate this forest from the preceding Typical subassociation. They are not confined to this forest and exceed to the Cryptomerietosum as well as to the Pinetosum. Not only other diagnostic species, but also character species occur with high presence and dominance. Among the companions, there are many species of the oak forest occurring in high constancy. From the floristic speciality, the writer came to the conclusion that in spite of the gradual change of physiognomy this forest should be treated as an independent subassociation, Tripetaleietosum. As the type stand for this subassociation is referred to a *Fagus crenata–Hamamelis japonica* var. *obtusata–Tripetaleia paniculata–Vaccinium japonicum–Plagiogyria matsumureana–Shortia uniflora* sociation on HD 56 in Table 8 at Mt. Sanpoiwadake, Gifu Prefecture.

Regardless the altitude, this subassociation is distributed widely in the beech forest. It is mostly contiguous to the typical subassociation, although it frequently lies in contact with the other subassociations except the Aesculetosum. Generally it occurs on sunny and drier ridges, and the steepness seems less extreme compared with the Pinetosum.

The upper and lower shrub layers are characterized by luxuriant growth of many ericaceous species, such as *Tripetaleia paniculata, Rhododendron nudipes* and *Vaccinium japnonicum.* In the upper herb layer *Plagiogyria matsumureana* and

Rumohra mutica are found; in the lower herb layer, *Shortia uniflora* and *Carex morrowii* var. *temnolepis*.

The Typical and *Disporum smilacinum* variants are recongized, and the former is usually situated in somewhat lower parts than the latter.

F-1. Typical variant

Lacking in special differential species, this variant has *Cephalotaxus harringtonia* var. *nana* and *Quercus mongolica* var. *grosseserrata* with high presence. In the upper part of slopes it comes in contact with the Pinetosum. Moreover, it has all differential species of the subassociation with great dominance. According to these facts, its habitat seems to be drier than in the next.

F-2. *Disporum smilacinum* variant

Differential species: *Disporum smilacinum, Maianthemum dilatatum, Dolichomitriopsis crenulata, Rhus ambigua.*

This is characterized by the above-listed four species which are combined with each other rather weakly. Representative stands of this variant are found on flat ridges or the upper part of gentle slopes in some restricted areas. The floristic feature is similar to that of the Typical variant of the Typical subassociation. There are in the boundary area some vegetation types showing a transitional floristic composition between the two.

G. Subass. dryopteridetosum (Karizumi 1956) Sasaki 1970, Vegetatio 20: 222, Table 1. (Table 9)

Differential species: *Dryopteris austriaca, Smilacina yesoensis.*
Altitudinal range: 1170–1700 m.
Number of component species: 39 (27–53).

Karizumi (1956) first described the *Dryopteris austriaca* subassociation of the Saso kurilensis-Fagetum crenatae from Mt. Hachimantai in Tohoku region, indicating as differential species, *Dryopteris austriaca, Plagiogyria matsumureana, Heloniopsis orientalis, Smilacina yesoensis* and *Trillium smallii*. Afterwards Sasaki (1970) characterized it by only one differential species, *Dryopteris austriaca*, and enlarged its area from Hokkaido to Hokuriku.

In Mt. Hakusan the forest differentiated by the above-mentioned two differentials is recognizable. It ranges from the mid elevations to the subalpine zone, occurring on gentle, somewhat concave slopes and flat ridges where the snow is usually deposited more heavily and remain late.

The undergrowth is well developed. The shrub layer is two-storied; the upper dominated by *Sasa kurilensis*, the lower by *Ilex leucoclada, I. crenata* var. *paludosa* and *Skimmia japonica* forma *repens*. The herb layer consists of the upper fern layer of *Dryopteris austriaca, Rumohra mutica* and *Plagiogyria matsumureana* and the lower sedge layer of *Carex dolichostachya* var. *glaberrima* and *C. morrowii* var.

Table 8. Tripetaleietosum

1. Typical variant; 2. *Disporum smilacinum* variant

| Variant | 1 | | |

	MS	MS	HC	HA	HC	HD	MS	HB	HB	HD	HC	MS	HC	HD	HB	HD	HB	HC	HD	HC	MS	HC	DA	HC	HD	HB	HC	HC	MS	HB	HC	HC	HC	HE
	24	59	8	37	44	60	24	65	69	56	65	20	31	57	60	58	64	38	62	56	60	30	18	82	12	59	68	18	15	63	17	72	60	10
Moisture elements																																		
Cephalotaxus harringtonia var. nana	1.1	·	·	+	·	1.2	·	·	+	·	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Acer palmatum var. matsumurae	1.1	·	·	+	·	·	+	·	+	·	·	+	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	+	·	·	·	+	·
A. mono	+	·	·	+	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	+	2	·	·	+	+	·	·	·	·	·	·	·
Euonymus oxyphyllus	+	+	·	+	·	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	1.1	·	·	·	·	·	·	·	·	·	·	·	·	·
Hydrangea petiolaris	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·
Tilia japonica	+	·	·	·	1.1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Dry elements																																		
Leucobryum neilgherrense	+	·	+	·	·	·	2	·	·	1.2	·	+	·	·	·	·	+	2	+	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·
Ilex sugerokii var. brevipedunculata	·	·	+	·	·	·	·	·	+	2.2	·	·	·	·	·	·	·	+	1.2	·	·	·	1.2	+	+	·	·	·	·	·	2.2	2	·
Heloniopsis orientalis	·	·	·	·	·	·	·	2	·	1.2	·	·	·	·	·	1.1	·	·	+	2	·	·	·	·	·	+	·	·	·	·	·	·	·	·
Menziesia multiflora	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	2.2
Companions																																		
Fauriella tenuis	2	·	2	·	+	2	+	+	·	+	+	+	+	·	+	+	+	2	2	·	+	+	2	+	+	+	+	+	2	+	2	2	2	+
Thuidium kanedae	2	2	2	2	+	2	2	+	2	+	2	1.2	+	·	+	·	·	2	+	1.2	+	+	+	+	+	2	·	2	2	+	2	2	·	·
Acanthopanax sciadophylloides	+	·	·	·	·	·	·	+	+	2.1	·	+	2	+	+	·	+	1.2	1.1	1.2	·	2	1.1	·	+	+	2.2	+	1.2	2.2	1.2	+	2.2	1.1
Leucothoe grayana var. oblongifolia	·	·	·	·	·	1.1	1.1	·	·	·	+	·	·	+	·	1.1	·	·	1.1	·	·	·	·	1.1	2	·	1.1	·	·	·	·	2	+	1.1
Solidago virga-aurea var. asiatica	1.1	2	+	·	+	·	·	·	1.1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	2	·	+	·	+	2	·	·	·
Hydrangea paniculata	·	·	·	·	2	1.2	·	+	·	·	+	·	·	·	2	·	·	·	·	·	·	·	·	+	·	+	·	2	·	+	+	·	·	·
Kalopanax pictus	+	·	·	·	+	·	·	+	+	·	·	+	·	·	·	·	+	·	·	·	·	·	·	·	·	+	·	·	+	·	·	·	·	·
Anomodon rugelii var. rugelii	2	·	2	2	1.2	·	·	·	2	·	+	·	·	·	·	·	·	·	·	·	·	2	·	·	·	·	·	·	2	·	·	·	·	·
Corylus sieboldiana	+	·	·	+	·	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·	+	·	·	·	·	·	+	+	·	·	+	·	·	·
Dicranum nippononse	·	+	·	+	·	·	·	·	2	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	2	·	·	·	+	2	·	·	·
Plagiothecium euryphyllum	·	·	·	·	·	·	·	·	·	·	·	2	+	·	·	·	·	2	·	·	·	·	·	·	·	·	·	+	2	·	+	·	·	·
Tripterospermum japonicum	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	+	+	·	·	·	·	·
Pertya rigida	·	·	·	·	+	·	·	·	·	·	·	·	2	·	·	·	·	·	·	·	·	·	+	·	·	·	+	·	1.1	·	·	·	·	·
Acer distylum	·	·	·	·	·	·	·	1.2	·	·	·	·	2.2	·	·	·	+	·	·	·	·	·	·	·	·	·	·	1.1	·	+	+	·	·	·
Viburnum wrightii	+	·	·	1.1	·	·	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Diphyscium fulvifolium	+	·	+	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·
Ainsliaea acorifolia var. subapoda	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1.1	·	·	·
Thuidium bipinnatulum	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	2	·	·	·	·	·	·	+	+	·	·	·	·	·	·	·
Smilacina yesoensis	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·	·	·	+	·	·	·	·
Polygonatum lasianthum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	+	+	·	·	·	·	·	+	·	·
Carpinus japonica	·	2.2	·	·	·	1.1	·	·	·	·	2.2	·	·	·	·	·	·	3.3	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Vaccinium hirtum	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	+	·	·	·	·	·	·
Cornus kousa	+	·	2	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Brotherella hononii	·	+	·	·	·	·	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Brachythecium populeum	·	·	·	·	·	·	·	·	·	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·
Betula grossa	·	·	·	·	·	·	·	·	·	·	·	1.1	·	·	·	·	·	·	·	2.1	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Smilax nipponica	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	+	·	·	·
Ardisia japonica	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·	·	·	·	·	1.1	·	·	·	·	·	·	·
Rumohra miquoliana	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	1.1	+	·	·	·	·
Euonymus sieboldiana	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·
Cornus controversa	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	+	·	·	·	·	·
Alnus hirsuta var. sibirica	·	·	·	·	·	·	·	·	2.1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	2.1	·	·	·	·	·	·
Homalia japonica	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·
Rhynchostegium pallidifolium	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Pleopoltis ussuriensis var. distans	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Pyrola japonica	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·
Torreya nucifera var. radicans	·	·	2	·	·	·	·	·	·	·	·	·	2	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Cymbidium gooringii	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Polytrichum formosum	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Evodiopanax innovans	·	·	2	·	·	·	2	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Panax japonicus	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1.1	·	·	·	·	·
Shortia soldanoloides	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1.2	·	·	·	·	·
Vitis coignetiae	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·
Hypnum tristo-viride	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	2	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Plagiothecium nemorale	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Hypnum oldhamii	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Ribes ambiguum	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Hylocomium brevirostre var. cavifolium	·	·	·	·	·	·	·	2	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Hydrangea hirta	·	1.1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Monotropastrum globosum	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Schwetschkeopsis fabronia	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Stachyurus praecox	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Anomodon giraldii	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Rhytidiadelphus japonicus	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Athyrium squamigorum	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Magnolia obovata	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·

temnolepis. The undergrowth structure of this subassociation is identical to that of the Typical subassociation except the dominance of *Dryopteris austriaca* in the herb layer.

This subassociation is subdivided into two variants, which are segregated by the altitudinal range.

G-1. Typical variant

The vaiant usually occurs at elevations between 1500 m and 1700 m, where the beech forest attains the upper limit and is replaced by the subalpine forest of the Abietum mariesii. *Betula ermanii*, character species of the subalpine forest,

Table 9. Dryopteridetosum

1. Typical variant; 2. *Lindera umbellata* var. *membranacea* variant: a. *Osmunda asiatica* subvariant, b. Typical subvariant, c. *Cephalotaxus harringtonia* var. *nana* subvariant

Variant	1	2		
Subvariant		a	b	c
Quadrat number	HA HA HA HA HA HC HC HB HA HA HA MS HA HB HD HC HA HA HA HA HB HA HC HE HE HB HC MS HD MS HB HD HA HB HB HB HC HB HD HB			
Year of record	23 39 38 40 22 69 73 16 41 34 32 70 42 55 44 74 30 28 25 31 68 33 50 5 6 17 35 14 2 69 13 59 12 43 67 57 38 37 12 49			
Altitude (m)	72 72 72 72 72 74 74 73 72 72 72 71 72 73 75 74 72 72 72 72 73 72 74 76 76 73 74 70 75 71 73 75 72 73 73 74 73 75 73 73			
Slope aspect (°)	1680 1620 1700 1300 1250 1300 1110 1680 1670 1370 1300 1430 1340 1370 1500 1630 1520 1560 1510 1510 1210 1310 1250 1580 1180 1295 1440 1590 1360 1200 1200 1270			
Slope degree (°)	10 10 NE NE SE S 15 10 W 30 35 35 W E 35 30 35 35 S S 35 35 20 25 45 45 W W 25 W 30 35 35 W 40 45 W 35			
Microtopography	30 30 20 30 30 10 5 10 28 20 2 20 30 8 15 15 40 15 35 30 35 40 25 25 20 10 25 30 15 25 15 35 35 5 25 10 30 5 10 15			
Size of plot area (m^2)	u u u r m f f f r u f m m m f f m r m m u u m m m f m f m u m m m f u f m f f f			
Height of tree layer (m)	13 6 12 17 13 18 18 22 18 20 20 17 14 20 17 19 20 18 17 18 16 18 17 18 18 20 20 22 17 15 18 15 15 17 19 16 20 17 18 25			
Cover of tree layer (%)	70 60 60 80 70 90 95 95 80 80 80 95 70 90 85 90 95 80 95 70 90 90 95 95 100 100 95 100 95 90 90 70 95 75 90 95 90 90 90 95			
Height of subtree layer (m)	5 3 3 3 3 3 4 6 4 3 5 3 4 5 4 5 3 5 6 4 4 5 5 3 5 5 4 5 4 7 5 5 6 4 3 5 5 5 6			
Cover of subtree layer (%)	80 70 80 95 60 85 80 80 85 75 95 75 85 80 85 80 50 85 80 80 80 85 65 60 75 80 60 40 80 80 65 90 75 75 75 80 70 80 80 80			
Height of upper shrub layer (m)	1.5 1.5 1.0 2.0 1.5 1.8 1.5 1.5 2.0 1.8 2.0 1.3 1.2 2.5 2.0 1.5 1.5 1.8 1.5 1.8 1.5 1.5 1.5 1.8 1.0 1.2 1.5 1.0 1.0 1.5 1.5 2.0 1.5 2.0 1.5 1.5 2.0 2.0			
Cover of upper shrub layer (%)	95 75 80 80 95 80 65 40 80 60 90 70 70 70 60 40 70 100 90 85 95 45 85 70 50 30 60 60 60 80 80 30 90 40 70 40 40 35 50 20			
Height of lower shrub layer (m)	0.5 0.6 0.5 0.3 · · 0.6 0.6 0.7 0.7 0.5 0.6 0.7 0.5 · · 0.5 0.7 0.5 0.6 · 0.5 0.5 0.5 0.4 0.6 0.5 0.7 0.7 0.6 · · 0.5 0.6 · 0.5 · 0.6 0.7 ·			
Cover of lower shrub layer (%)	1.0 60 30 40 · · 40 40 30 40 30 30 60 50 · · 20 40 30 50 · 80 30 40 60 60 20 40 30 35 · · 30 30 · 50 · 30 35 ·			
Height of upper herb layer (m)	0.3 · 0.3 0.4 · 0.5 0.5 0.4 0.5 0.3 0.3 0.3 0.3 0.4 0.4 0.4 0.3 0.6 0.3 0.4 0.5 0.3 0.4 0.3 0.4 0.5 0.4 0.3 0.3 0.4 0.7 0.5 0.4 0.5 0.3 0.5 0.4 0.4 0.4 0.4			
Cover of upper herb layer (%)	1.0 · 70 30 · 15 70 70 70 20 70 30 40 30 10 50 70 20 40 20 20 60 30 70 40 40 70 85 50 40 40 100 95 60 60 55 80 70 45 50 80			
Height of lower herb layer (m)	0.1 0.2 0.1 0.2 0.1 0.1 0.1 0.1 0.1 · 0.1 · 0.1 0.2 0.1 0.1 0.1 0.2 0.2 0.1 0.2 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.2 0.2 0.1 0.1 0.1 0.1 0.1 0.2			
Cover of lower herb layer (%)	50 80 60 60 70 40 60 30 · 50 · 70 65 50 70 45 40 50 55 60 30 30 80 30 50 80 70 10 80 50 85 40 80 65 50 50 60 80 15 70			
Number of species	30 28 31 27 31 38 44 38 30 38 35 35 46 38 32 43 35 37 40 41 38 44 41 40 44 41 42 40 34 43 34 41 44 51 47 31 50 35 40 53			
Soil type	Bc40 · Bc40 · Bc40 Bc40 Bc40 · · · gBc Bp · gBc · gBc · gBc Bp Bp · · · gBc Bc Bc Bc · · · Bc40 Bc40 Bc40 gBc Bc40 Bc · gBc gBc gBc Bc · Bc40			
Mode of deposition	d · d · d · · · · · Y · · · · · d · · · · · r r r · · · · · r x · r d · · · · · Y · d			
Differential species of Subassociation				
Dryopteris austriaca	1.2 + 3.3 2.2 1.1 2.2 2.2 3.3 1.1 3.3 3.3 2.2 + 1.1 2.3 4.4 1.1 3.3 1.2 1.1 2.2 1.1 4.4 1.1 + 2 3.3 4.4 1.1 2.2 + 2.5 5 4.4 3.3 2.2 2.2 4.4 3.3 2.2 3.3 4.4			
Smilacina yesoensis	· · + · · + · + 2 · · · + · · 1.1 + · 1.1 · · 1.1 · + 2 · · + 2 + 2 1.1 + · · · · 1.1 + 2 + 2 + + · ·			
Differential species of Variant				
Lindera umbellata var. *membranacea*	· · · · · 2 2 1.2 + + 2 + · · 1.1 + · 1.1 1.2 + 2 + 1.1 2.2 + + 2 3.3 2.2 1.1 1.1 + 2.3 + + 2 1.1 + 1.1 + 2 2.2 1.1 1.1 1.2 +			
Prunus grayana	· · · · · 4 2 1.2 1.2 + 1.1 + 1.1 1.2 1.2 · 3.3 + + 2 + 1.2 1.1 + + 1.1 1.1 + 2 + + 1.1 · · 1.1 + 2 + 2 + 2 1.2 · · · +			
Maianthemum dilatatum	· · · · · 1.1 1.2 1.2 · 2.2 + 1.2 · 2.2 3.3 1.1 1.1 1.1 + 2 · + + 2 + 1.2 + + 2.2 1.1 · + 1.1 · 2.2 · 1.1 · 1.1 · · ·			
Dolichomitriopsis diversiformis	· · · · · 1.2 + 2 · + 2 · · + 2 + 2 + 2 + 2 · · + · · + 1.2 + + 2 + + 2 · + 2 1.2 1.2 + 2 · 1.2 + + 2 + + 2 1.2 + 2 1.2 +			
Smilacina japonica	· · · · · + · + · 2.2 + · · + · 1.1 + · + 1.1 1.1 1.1 1.1 + 2 1.1 + 2 + 1.1 · · 1.1 · + 1.1 1.1 + 2 1.1 + 1.1			
Ainsliaea acorifolia var. *subapoda*	· · · · · 1.1 + 2 + 2 · · · · + 1.2 · + · + · · 2.3 1.1 · 1.1 2.2 · · · · · · 1.2 · 2.2 · · 2.2 1.1 1.2 2.3			
Hamamelis japonica var. *obtusata*	· · · · · + 2 2 2.2 · · + · 2.2 · · · · · 1.1 · · · + + · 1.1 · · · 1.2 · + 2 · 1.2 + 2 · · 1.2 · · ·			
Clethra barbinervis				
Differential species of Subvariant				
Osmunda asiatica	· · · · · 4.4 2.3 ·			
Menziesia pentandra	· · · · · 2.2 2.2 ·			
Athyrium yokoscense	· · · · · 1.2 2.2 ·			
Cephalotaxus harringtonia var. *nana*	· ·			· · · · · + 2 1.1 1.1 1.1 1.1 2 + · · · 2.2 · 2.2 1.1
Acer palmatum var. *matsumurae*	· ·			1.2 1.2 + 2 · 1.2 · · 1.2 · · · 2.2 · · · · + 2 3.3 1.2 1.2
Aucuba japonica var. *borealis*	· ·			· · + 2 1.1 + 2 + 1.1 · 1.2 · · · 1.1 + 2 1.1 1.2 · 1.1 · ·
Athyrium otophorum	· ·			· · · · · · · · · · + · · + + + 1.1 1 + + 2
Thamnobryum alopecurum	+ ·			· · · · · + · · · · · + 2 · + + 2 + · · + + · + 2
Character species of Association				
Fagus crenata	3.4 4.4 4.4 5.5 4.4 5.5 5.5 5.5 5.5 5.5 5.5 4.4 4.4 5.5 5.5 5.5 5.5 5.5 4.4 4.4 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5 4.4 5.5 5.5 5.5 4.4 3.3 5.5 5.5 5.5			
Ilex leucocolada	+ 1.1 1.1 1.1 1.1 + 1.2 1.2 1.2 1.1 2.2 2.2 1.1 1.1 2.2 + 2 1.1 1.1 2.2 1.1 2.2 + 2 2.2 1.1 · 1.1 1.1 · + 2 · 2.1 + 2 1.1 + 2 1.1 + +			
Acer japonicum	+ 3.3 · 3.3 + 2 + 2 · + 2 + + + · + + 2 2.2 2.3 + + 1.2 1.1 1.2 2.2 + 1.1 2.2 1.2 1.2 · 2.2 1.1 2.2 1.1 + 2 1.2 · + 2.2 2.2 · 2.2 +			
Hylocomiopsis ovicarpa	· + + 1.2 1.2 + + + 2 + + 2 1.2 + + 2 1.2 + · + 2 2.1 2.1 2 1.2 + 2 1.2 1.2 · + 2 1.2 · + 2 + · 1.2 1.2 + 1.1 + 1.2 + 2 1.2 + + 2 1.2 + + 2			
Brachythecium brothori	· · + 2 · + · + + 2 · + + 2 · · · · + 2 · + + 2 + + + + 2 + 2 + 2 + 2 · · + + + + 2 + 2 1.2 + 2 + 2 1.2 1.2 + 2 + 2			
B. rhynchostegielloides	+ + 1.2 + + 2 + · + 2 · · + 2 · + 2 · + + 2 + + 2 + + + · · + 2 · · + + + + 2 · + 2 · + 2 +			
B. coreanum	· · + 2 + 2 · · + + 2 + 2 + · + 2 + 2 + + 2 + 2 + 2 · · + · · · · + 1.2 + 2 + 2 1.2 · + 2 + + 1.2 + + · · + 2 + 2 + 2			
Magnolia salicifolia	· 1.1 1.2 2.3 + 1.2 + 2 · 1.2 + 1.1 1.1 + 2.2 · + 2 + · · 1.1 · · + 2 1.1 2.2 + · · · · + · + · 2.3 + 2 + 2 · · · ·			
Skimmia japonica forma repens	1.1 · 1.1 · + 2 + 1.2 1.2 · · + 1.1 1.1 2.2 1.2 · · + 2 1.2 2.2 · · 1.1 1.1 1.1 1.1 · 1.1 · + 2 · · + · + 2 · · · · ·			
Carex morrowii var. *temnolepis*	3.3 3.3 1.2 · 1.2 · · · · · · · 3.3 · · · 1.1 · 3.3 3.3 · 1.1 · · · · · · · · · · + 2 · 4.4 2.2 · · 3.4 · · + 2			
Paris tetraphylla	· · · · · + · + 2 · + · · · · + 2 + 2 + · · · + · · · · + + · · · · + 2 · + 2 · · + · + · · +			
Acer micranthum	· · · · · · · 1.2 + 2 · · · · · · · · · · · · · + · · + · + 2 + 2 + · 2.2 · · + · · · 1.1 2.2 · +			
Daphniphyllum macropodum var. *humile*	· · · · · · · · · · · · 1.1 · 1.1 1.1 1.2 · · · · · 1.1 · + 2 · · 1.1 · · 2.2 · 2.2 · + 2 · · · · · · · · ·			
Goodyera maximowicziana	+ · 1.2 · + + · 1.1 · · · · · · · 1.1 + 2 + · · · · · · · ·			
Hypnum fujiyamae	· · · · · · · · · · · + · + 2			
Transgressive species to the subalpine birch-fir forest				
Sasa kurilensis	5.5 3.3 5.5 4.4 5.5 · + · + 1.2 5.5 3.3 5.5 4.4 2.2 3.4 3.3 · 3.3 5.5 5.5 4.4 1.1 2.2 3.3 + 2 + 2 + 2 3.3 3.3 2.2 1.2 · 5.5 5.5 + 3.4 + 2 · 1.2 2.2 1.2			
Viburnum furcatum	4.4 2.2 3.3 3.3 3.3 4.4 4.4 3.3 3.3 4.4 4.4 3.3 3.3 3.3 4.4 3.3 3.3 5.5 4.4 4.4 4.4 3.3 4.4 3.1 3.3 3.3 3.3 3.3 3.3 3.3 3.3 2.2 3.3 4.4 3.4 5.5 4.4 4.4 2.2 3.3 4.4			
Carex dolichostachya var. *glaberrima*	1.1 2.2 3.3 4.4 4.4 2.2 1.2 1.2 + 2.1 1 + 2.3 3 · 1.1 2.2 1.2 1.1 3.3 3.3 1.1 1.2 + 4.4 1.1 1.2 3.3 4.4 · 5.5 2.2 4.4 1.2 · 1.1 2.2 1.1 3.3 4.4 4.4 3.4			
Sorbus commixta	1.2 1.1 2.2 3.3 1.2 1.1 1.1 · 1.2 · · · + 2 1.2 · + + 2 · · · · + 2 + + + 2 + · · + · + 2 · · · + + 2 + + 2 + 2			
Dicranum viride var. *hakkodense*	· + 2 + 2 + 2 · + 2 + 2 1 + 2 + · + + 2 + 2 + 2 + 2 + + 2 + + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 · 1.2 + + 2 · + 2 + + 2 + + 2			
Plagiogyria matsumureana	+ · 2.2 + 2 · 2.3 1.2 1.2 + 2 + · 1.1 1.1 · 1.2 + · · · · · + · 1.1 + 2.2 1.2 · 2.2 2.3 2.2 3.3 2.3 · + 2.3 3 1.2 2.3 1.2			
Rumohra mutica	+ + 1.1 1.1 · + 2 1.2 + 2 + 2 · · 1.1 1.1 + · + · · + · + + + 2 · + 2.3 3 1.2 · 1.1 · 1.1 1.2 · · · + 2 · · + 2 +			
Dolichomitriopsis cronulata	+ 2 + 2 + 2 1.2 1.2 · 1.2 + 2 + 2 · · · + 2 + + 1.2 + 2 + · · · · · · 1.2 + · · + 2 1.2 + 2 1.2 + 2 · + · · + 2 · +			
Acer tschonoskii	+ · + 2 · 1.1 · · · · · 1.2 1.1 · + 2 + 2 · + + 2 · 1.2 + 2 · · · · · · · · · · · + · · · · · · · · · ·			
Hylocomium pyrenaicum	· · · + 2 · · · · · · r · · · · · + 2 · · · · · · · + + · · · 1.2 · · · 1.2 + · + 2 + 2 + + 2 +			
Rigodiadelphus robustus	· + 2 + + + 2 · + · · · + · + · · · + + + · + ·			
Hypnum pallescens	· · · · + + + · · · · · + · + · · · · · · · · + · + · · · · · · · · + · + · · · · ·			
Lycopodium serratum var. *serratum*	· · 1.2 + · 1.2 1.2 + 2 · · · · 1.2 · · · · · · · · · · · · · · · · · · 1.2 · · · · · · · · 1.2 · · · · · ·			
Clintonia udensis	· + · · · · · · · · · · · · · · · · + + · + · + 2 · · · + ·			
Trachycystis flagellaris	· · · · · + · · · · · · · · · · · · · · · · + · · · · · · · · · · · + 2 · + · · · + · · +			
Streptopus streptopoides var. *japonicus*	· · · · · · + · · · · · + · + 1.1 ·			
Calliciadium haldanianum	· + · · · · · · · · + · + · ·			
Rhododendron albrechtii	· + · · · · · · · · · · · · · · ·			
Dicranum scoparium	· + · · + 2 · · · · ·			
Transgressive species from the submontane oak forest				
Schizophragma hydrangeoides	+ · · + + 2 1.1 · · + 1.1 + 1.2 + + · 1.1 + + + 2 + + 2 + + 2 2 2 + 2 + 2 1.1 1.2 2 · + 2 · 1.2 1.1 + + 2 2 1.1 + 2 2 2 1.1 +			
Rhus ambigua	· + + + · 1.2 + 2 1.2 + 1.1 1.1 2.2 · 2.2 + 2 2 2 + + · 1.1 1.2 + + 2 1.2 + 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.1 2.1 2.1 1.2 2 · + + 2 + 2			
Acer rufinerve	· · · 1.1 + 2 1.2 1.2 1.2 1.1 1.1 + + 2 + 1.1 · 2.2 · + 2 · 1.1 + 2 + + 2 2 1.1 1.1 · + + 2 1.2 2 2 2 1.1 1.1 + + 2 + 2 + 2 + 2 2 + 2			
Rhus trichocarpa	· + · + · 1.1 1.1 2 2 + 1.1 1.1 1.1 1 + + 2 · + + · + · · + · 2 2 1.1 · · · + 2 2 + 2 2 2 2 1 + 2 1.1 · · +			
Ilex crenata var. *paludosa*	· 2.2 · 1.1 · · 1.2 + 1.1 2.2 · · · + 2 + 2 · · · · · · · · · + 2 + · 1.1 1.2 + · + · + · · + · 1.1 ·			
Hitchella undulata	· 1.1 · · · 1.1 1.1 + · · + 1.1 1.1 · · · · + · · · · · · + + 2 · · · · · · · 1.1 · 2.2 · + · · + 1.1			
Vaccinium japonicum	· 1.1 · · · + 2 + · · · · + 2 2 · · · · · · + · · · · + 2 · · · · + 2 · · · · + + · · · · · · · · ·			
Fraxinus lanuginosa	· · · · · · · · · · · · · · · · · · + · · + · + + 2 · + · · · · · + · + · + 2 · ·			
Symplocos paniculata	· · · · · · · · + 2 · · · · · · · · + 2 · + 2 2			

	HA 23	HA 39	HA 38	HA 40	HA 22	HC 69	HC 73	HB 16	HA 41	HA 34	HA 32	HS 70	HA 42	HB 55	HD 44	HC 74	HA 30	HA 28	HA 25	HA 31	HB 68	HA 33	HC 50	HE 5	HE 6	HB 17	HC 35	HS 14	HD 2	HS 69	HB 13	HD 59	HA 12	HB 43	HB 67	HC 57	HB 38	HD 37	HB 12	HB 49
Disporum smilacinum	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+2	·	·	·	·	·	·	1.1	·	+2	2.2	·	·	1.1	·	1.1	·	+2	·	1.1	·	·	·	·	·	·
Blechnum niponicum	+	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·	·	·	·	+	·	·	+2	·	·	+	·	·	·	·	·	·	·
Sorbus alnifolia	·	·	·	·	·	·	·	·	·	·	+	·	2.1	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	1.1	·	·
Quercus mongolica var. *grosseserrata*	·	1.1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Moisture elements																																								
Acer mono	·	·	·	·	·	·	·	·	+	·	·	·	·	+	·	+	·	+2	+	·	+	33	·	+2	2.1	·	+2	+	·	·	·	·	+	·	+	3.2	+2	·	+2	+2
Euonymus alatus forma *ciliatodentatus*	+	·	·	·	+	·	·	+	·	·	·	+2	·	·	·	+	·	+	+	+	+	+2	·	·	·	·	+	·	·	·	·	+	·	·	·	·	·	·	·	·
E. oxyphyllus	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1.2	1.1	·	+	+2	1.2	+2	+	·	·	·	+	·	·	·	·	·	·	+2	·	+2	·	·	+
Tilia japonica	+2	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+2	2.1	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·
Hydrangea petiolaris	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+2	·	·	+2	·	·	·	·	·	·	·	+2	·	·	+2	·	+2	·	·	·
Dry elements																																								
Menziesia multiflora	·	·	·	·	·	·	·	·	·	·	·	·	22	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Companions																																								
Acanthopanax sciadophylloides	+2	+	+2	·	+	2.2	1.2	1.2	+	1.1	1.1	3.3	2.2	1.2	1.1	2.2	1.2	1.1	+	1.2	2.2	1.1	+2	1.1	+2	1.2	1.2	·	2.3	1.1	·	2.2	+	1.2	+2	1.2	+2	1.1	1.2	+
Fauriolla tenuis	·	1.2	+	+2	·	+	+2	+	+2	+	+	+2	+	·	·	+	+	+	+2	+	+2	+	+2	+	+2	+	+	·	+2	·	+	+2	+	·	·	+2	+2	·	+	·
Hydrangea paniculata	·	·	·	·	+	+2	·	+	·	+	·	+	·	+2	·	+2	·	·	·	1.1	·	·	·	·	·	·	1.2	·	·	+2	2.3	·	+2	+	+	·	+2	+2	+2	·
Cornus controversa	·	·	1.2	1.1	·	·	·	·	2.3	+2	·	·	·	·	1.1	2.1	+	·	+	·	+	+	+2	·	+2	3.3	1.2	·	1.1	·	1.1	1.2	·	·	·	+2	·	·	+2	+
Thuidium kanedae	·	·	·	·	·	·	·	+2	·	·	·	+2	·	+2	·	+	·	·	·	·	·	·	·	+2	+	+	+2	+	+2	·	1.2	·	1.2	+2	+2	+2	1.2	·	+2	+
Corylus sieboldiana	+	·	1.2	+	+	·	·	·	·	·	·	·	1.1	·	+2	+2	·	+	·	·	+	+	·	+	·	·	1.2	+	·	·	+	+	+	·	·	+2	·	·	+	·
Smilax nipponica	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	+	·	+	+	+	·	+	·	·	·	+	·	+	·	+	·	+	+	+	·	+	·	·	·	+
Fissidens cristatus	·	·	·	·	·	·	·	·	·	·	+	·	+2	+2	·	·	·	·	+	+2	·	·	·	·	+2	+2	·	·	·	·	+	·	·	+2	·	·	+2	+	·	+
Panax japonicus	·	·	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+2	+	+	·	·	·	·	+	·	·	+2	·	·	+2	+	·	+	+	·	·
Anomodon rugelii var. *rugelii*	+	·	·	·	·	·	·	·	+2	·	+	·	·	+	·	·	+	+2	+	·	·	·	·	·	·	·	·	1.2	·	·	·	·	·	+2	+2	·	·	·	·	+
Cacalia nikomontana	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	1.1	+	+2	1.1	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	+2	·	·	·
Brachythecium populeum	·	·	·	·	+	·	·	·	·	·	·	+2	·	·	+2	·	·	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·
Tripterospermum japonicum	·	+	·	·	·	·	·	·	·	·	·	+	·	+	·	·	·	·	·	+	·	+	·	·	·	·	·	·	·	+	·	·	·	+	+2	·	·	·	·	·
Thuidium bipinnatulum	+	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	+	·	·	·	+	·	·	·	·	·	+	·	+	·	+	·
Oxalis griffithii	·	·	·	·	·	·	·	·	·	·	·	+2	·	·	1.2	+	·	·	·	·	·	·	·	1.1	·	+	·	·	·	·	·	·	·	+2	+	·	·	+2	·	1.2
Kalopanax pictus	·	·	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	+2	·	·	·	·	2.1	·	·	·	·	·	+2	+	+	·	·	·	·	·	·
Clinopodium gracile var. *multicaule*	+	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	+	+2	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Plagiothecium euryphyllum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	+2	·	+2	·	·	+	·	+	·	·	·	+	·	+	·
Athyrium squamigerum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	+	·	·	·	1.1	·	·	·	·	·	+	·	·	·	+	+	+
Peracarpa carnosa var. *circaeoides*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+2	·	+2	·	·	·	·	·	·	·	·	·	+	·	·	+2	·	·
Cacalia adenostyloides	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	+	+	·	·	·	+	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	+2
Betula ermanii	·	·	2.1	·	2.1	·	·	·	2.1	·	·	·	·	·	·	·	·	·	2.1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Magnolia obovata	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+2	+2	·	1.2	·	·	·	·	·	·	·	+2	·	2.1	·
Rodgersia podophylla	33	·	2.1	·	2.2	·	·	·	2.1	·	·	·	·	·	·	·	·	·	22	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Dryopteris monticola	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+2	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	+2	·	·	·
Hydrangea macrophylla var. *megacarpa*	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+2
Ribes ambiguum	·	·	·	·	·	·	+	·	·	·	·	+2	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Trillium smallii	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·
Solidago virga-aurea var. *asiatica*	·	·	·	·	·	·	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Monotropastrum globosum	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Pertya rigidula	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	+2	·	·	·	·	·	·	·	·	·	·	·	·	·
Disporum sessile	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+2
Viola vaginata	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	+2	·	·	·	·	·	·	·	·	·	·	·	·
Atrichum undulatum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	·	·	·	·
Haplocladium angustifolium	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Thuidium glaucinum	·	·	·	·	·	·	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Dicranum nipponense	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+2	·	·	·	·	·	·	·	+
Brotherella henonii	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Anomodon rugelii var. *ferrugineus*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·
A. giraldii	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+2	·	·	·	·	·	·	·	·	·	·	·	·
Rhizomnium nudum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·
Diphyscium fulvifolium	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Plagiomnium trichomanes	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+2	·	·	·	·	·	·	·	·	·	·
Myuroclada maximowiczii	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+2	·	·	·	·	·
Sambucus sieboldiana	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·
Pterocarya rhoifolia	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+2	·	·	·	·
Polygonatum lasianthum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Polygonum debile	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+
Pyrola japonica	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Clematis japonica forma *purpureo-fusca*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Ardisia japonica	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Betula grossa	·	·	·	·	·	·	·	·	·	·	·	·	2.1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Actinidia arguta	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Lycopodium obscurum	·	1.1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Leucothoe grayana var. *oblongifolia*	·	·	·	·	·	·	1.1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Rumohra miqueliana	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1.2	·	·	·	·	·	·	·	·	·	·	·	·	·
Phellodendron amurense	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1.1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Vaccinium hirtum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Rumohra maximowiczii	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+2	·
Ligustrum tschonoskii	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·
Homalia japonica	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·
Ctenidium pulchellum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·
Brachythecium kuroishicum	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
Hypnum callichroum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·
Brachythecium plumosum	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·

grows more abundantly and vigorously mixed with *Sorbus commixta,* while beech trees become less abundant and somewhat deformed. The boundary of the two forests is thus rather gradual.

The writer found in the Hakusan-range that occurrence of this variant is strictly confined to the east, contrary to the occurrences of most other subdivisions of the Abietetosum, exceping the subvariant of *Osmunda asiatica.*

G-2. *Lindera umbellata* var. *membranacea* variant

Differential species: *Lindera umbellata* var. *membranacea, Prunus grayana,*

Maianthemum dilatatum, Dolichomitriopsis diversiformis, Smilacina japonica, Ainsliaea acerifolia var. *subapoda, Hamamelis japonica* var. *obtusata, Clethra barbinervis.*

The floristic composition of this variant, which occupies the main part of the beech forest in Mt. Hakusan, resembles closely that of the Typical subassociation. But this is distinguished from most other subassociations by the vigorous occurrence of *Dryopteris austriaca.*

Three subvariants are ditectable.

G-2-a. *Osmunda asiatica* subvariant

Differential species: *Osmunda asiatica, Menziesia pentandra, Athyrium yokoscense.*

This develops in patches only in depressions on the falt ridge of Mt. Sanpoiwadake. The snow stays late and the soil is kept wet there.

G-2-b. Typical subvariant

Among the three subvariants this is most widely distributed in more variable habitats: plain, gentle slopes, foggy summits and ridges. The higher dominance of *Sasa kurilensis* and *Ilex leucoclada* is an apparent sign in the field.

G-2-c. *Cephalotaxus harringtonia* var. *nana* subvariant

Differential species: *Cephalotaxus harringtonia* var. *nana, Acer palmatum* var. *matsumurae, Aucuba japonica* var. *borealis, Athyrium otophorum, Thamnobryum alopecurum.*

This is found on mesic soil on moderate slopes. Its flora resembles that of the *Acer mono* variant of the Typical subassociation, but the difference is clear by the differential species. Moreover, *Acer micranthum* and *Smilacina japonica* occur more abundantly in this subvariant than in the others.

H. Subass. abietetosum Haneda et al. 1970, Note on the Vegetation of the Okushiga Mountains in Shiga Heights, p. 5, Table 6 (6 records from Okushiga). (Table 10)

Differential species: *Abies mariesii, Cornus canadensis, Coptis trifolia.*
Altitudinal range: 1410–1655 m.
Number of component species: 38 (33–46).

Haneda et al. (1970) originally described the *Abies mariesii* subassociation within the Lindero membranaceae-Fagetum crenatae, characterized by several differntial species such as *Abies mariesii, Maianthemum dilatatum, Menziesia pentandra* and *Oxalis acetosella,* from Okushiga in Nagano Prefecture, middle Honshu. Among these, only *Abies mariesii* occurs as a differential species in Mt. Hakusan. Although the delimitation is somewhat obscure, this subassociation should be recognized in Mt. Hakusan. Its floristic characteristics are: almost lack of

Acer micranthum, Hypnum fujiyamae; weak development of *Acer sieboldianum, Daphniphyllum macropodum* var. *humile, Smilacina japonica* and *Goodyera maximowicziana*; and frequent occurrences of *Maianthemum dilatatum, Acer tschonoskii, Sorbus commixta, Clintonia udensis* and *Dolichomitriopsis crenulata.* Most species of the last group usually grow in the subalpine forest, indicating the humid condition of the forest.

This subassociation develops on flat ridges or around moors. Its altitudinal range is narrow, because the habitat of *Abies mariesii* itself is limited in Mt. Hakusan.

The undergrowth is well developed, and both the shrub and the herb layers are almost identical to those of the preceding two subassociations, Typical and Dryopteridetosum. In the sedge layer, *Cornus canadensis, Maianthemum dilatatum* and *Clintonia udensis* are common, although *Carex morrowii* var. *temnolepis* is restricted to the particular variant.

The subassociation is subdivided into the following two variants in which the floristic composition and the habitat are clearly differentiated from each other.

H-1. *Carex morrowii* var. *temnolepis* variant

Differential species: *Carex morrowii* var. *temnolepis, Vaccinium hirtum.*

This is found mainly on flattened ridges of the western part of Mt. Hakusan, where the habitat is medium-insolated and windy with lighter snowdrifts, attaining altitudinally higher than the next. Sometimes it lies in contact with the Abietum mariesii. In the undergrowth, *Sasa kurilensis* is more vigorous than in the next variant. *Carex morrowii* var. *temnolepis* grow vigorously in the lower herb layer.

It includes two subvariants.

H-1-a. Typical subvariant

The Typical subvariant represents an example of the subassociation developed at the highest altitude, and is characterized by more luxuriant growth of the differential species of this subassociation. *Cornus canadensis* is luxuriant in the lower herb layer.

H-1-b. *Menziesia pentandra* subvariant

Differential species: *Menziesia pentandra, Dicranum scoparium, Rhododendron metternichii* var. *hondoense, Paris tetraphylla, Magnolia salicifolia, Lindera umbellata* var. *membranacea.*

This occurs altitudinally between the preceding subvariant and the next variant, and is characterized by increased number of beech forest species. The floristic composition is similar to that reported by Haneda et al. (1970).

H-2. *Ilex sugerokii* var. *brevipedunculata* variant

Table 10. Abietetosum

1. *Carex morrowii* var. *temnolepis* variant: a. Typical subvariant, b. *Menziesia pentandra* subvariant; 2. *Ilex sugerokii* var. *brevipedunculata* variant

Variant	1									
Subvariant	a									
	HD	HD	HA	HD	HC	HC	HC	HS	HC	HC	HC
Quadrat number	46	45	6	43	22	20	21	18	52	54	53
Year of record	75	75	72	75	74	74	74	71	74	74	74
Altitude (m)	1655	1655	1640	1500	1520	1580	1550	1420	1420	1420	1410
Slope aspect (°)	SE	SE	SW	SE	NW	NW	SW	NW	SE	SW	SW
Slope degree (°)	40	25	70	35	50	20	20	45	70	35	20
Microtopography	30	30	15	28	10	20	15	35	20	5	5
Size of plot area (m^2)	r	r	r	r	r	r	r	r	l	f	f
	12/10	10/10	15/10	10/10	10/10	10/10	10/12	10/15	10/13	12/12	15/15
Height of tree layer (m)	10	10	12	15	14	6	16	16	14	16	17
Cover of tree layer (%)	85	85	95	70	95	90	95	95	50	75	95
Height of subtree layer (m)	2.5	2.5	3.0	4	4	4	5	4	5	5	5
Cover of subtree layer (%)	60	70	80	50	85	70	90	80	85	85	80
Height of upper shrub layer (m)	0.8	1.0	1.5	1.8	2.0	2.0	2.0	1.5	1.5	2.0	1.2
Cover of upper shrub layer (%)	100	100	70	100	85	90	85	60	65	60	70
Height of lower shrub layer (m)	·	0.8	0.6	0.7	0.6	·	·	·	0.5	0.5	0.6
Cover of lower shrub layer (%)	·	40	40	50	45	·	·	·	40	70	40
Height of upper herb layer (m)	·	0.3	·	·	0.3	0.3	0.4	0.4	0.4	0.5	0.5
Cover of upper herb layer (%)	·	40	·	·	60	35	50	40	40	60	60
Height of lower herb layer (m)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cover of lower herb layer (%)	70	65	60	85	50	40	40	50	50	50	40
Number of species	30	33	34	33	38	41	38	38	46	44	42
Soil type	Bd	RaBrRa	Ra	.	BrRaBrRa	BrRa	BrRa	BrRa	.		
Mode of deposition	r										
Differential species of Subassociation											
Abies mariesii	2.2	2.2	+.2	1.1	+	2.3	1.2	1.1	1.2	·	·
Cornus canadensis	3.3	2.2	3.3	1.2	·	·	·	·	1.1	1.1	+2
Coptis trifolia	·	+2	·	·	·	·	·	·	+2	·	1.1
Differential species of Variant											
Carex morrowii var. *temnolepis*	1.2	2.2	2.2	·	3.3	2.3	2.2	·	·	·	·
Vaccinium hirtum	+2	+2	+	+	·	·	·	·	·	·	·
Ilex sugerokii var. *brevipedunculata*	·	·	·	·	·	·	·	+.2	1.2	1.2	+.2
Acer sieboldianum	·	·	·	·	·	·	·	+	2.1	2.1	+2
Smilacina japonica	·	·	·	·	·	·	·	+	·	+	+
Prunus grayana	·	·	·	·	·	·	·	·	+2	+2	+2
Daphniphyllum macropodum var. *humile*	·	·	·	·	·	·	·	·	+2	1.2	2.3
Sorbus alnifolia	·	·	·	·	·	·	·	·	2.1	1.2	+
Osmunda asiatica	·	·	·	·	·	·	·	·	+2	2.3	3.3
Lycopodium obscurum	·	·	·	·	·	·	·	·	1.1	+2	1.1
Athyrium yokoscense	·	·	·	·	·	·	·	·	·	+2	+
Differential species of Subvariant											
Menziesia pentandra	·	·	·	+.2	1.2	+	1.2	·	+	·	·
Dicranum scoparium	·	·	·	+	+2	+2	+	·	·	·	·
Rhododendron metternichii var. *hondoense*	·	·	·	·	+	1.2	·	·	·	·	·
Paris tetraphylla	·	·	·	+2	+	+	+	+	1.1	+.2	+2
Magnolia salicifolia	·	·	·	2.2	·	1.2	3.3	1.1	2.3	2.2	2.2
Lindera umbellata var. *membranacea*	·	·	·	·	+	+	+	1.1	1.1	·	+2
Character species of Association											
Fagus crenata	5.5	5.5	4.4	5.5	5.5	3.4	5.5	5.5	3.4	4.4	5.5
Acer japonicum	+	1.1	+	2.2	+2	+2	+2	2.1	2.2	1.2	1.2
Ilex leucoclada	1.1	1.1	1.1	1.1	+	+	·	+	1.1	2.2	1.1
Hylocomiopsis ovicarpa	+	·	+2	+2	1.2	+	1.2	1.2	+2	+	+2
Skimmia japonica forma *repens*	+	·	+	·	1.1	+	·	+2	+2	1.1	+
Dolichomitriopsis diversiformis	·	+	+2	+2	·	·	·	1.2	+	+2	+
Brachythecium coreanum	+	+	·	·	·	+2	+2	1.2	·	+	+
B. rhynchostegielloides	·	·	·	·	+2	·	·	·	+	+	+
B. brotheri	+2	·	·	·	+	·	+2	·	·	·	·
Goodyera maximowicziana	·	·	·	·	·	·	·	·	·	+2	·

	HD 46	HD 45	HA 6	HD 43	HC 22	HC 20	HC 21	MS 18	HC 52	HC 54	HC 53
Transgressive species to the subalpine birch-fir forest											
Viburnum furcatum	3.3	4.4	3.3	3.3	3.4	1.2	2.2	3.3	3.3	3.3	3.3
Sasa kurilensis	5.5	5.5	5.5	3.3	5.5	5.5	5.5	3.3	3.3	3.3	3.4
Maianthemum dilatatum	3.3	3.3	1.1	3.3	2.2	1.1	2.2	+.2	+.2	1.1	1.1
Acer tschonoskii	+.2	1.1	1.2	1.1	2.3	2.3	1.2	2.2	+	1.2	·
Dolichomitriopsis crenulata	1.2	+	+.2	+.2	+.2	+.2	+.2	+	+.2	·	+.2
Dicranum viride var. *hakkodense*	+.2	·	+	1.2	+	+.2	+	+.2	1.2	+	+
Plagiogyria matsumureana	1.1	2.2	+	·	2.3	2.2	2.2	2.2	2.2	+.2	·
Rumohra mutica	·	1.1	+	+	1.2	·	+.2	1.1	1.2	1.2	1.2
Sorbus commixta	+	+.2	+	1.2	1.2	·	2.2	·	+	1.2	2.2
Clintonia udensis	+.2	1.1	2.2	+.2	2.2	+	1.1	·	1.2	1.2	1.1
Rigodiadelphus robustus	·	·	+.2	·	+	+	+	+	+	+	+
Streptopus streptopoides var. *japonicus*	+	+.2	1.1	·	+.2	+	1.1	·	+	·	·
Lycopodium serratum var. *serratum*	+.2	·	·	1.2	·	·	1.2	+	·	+.2	·
Rhododendron albrechtii	·	+.2	·	+.2	1.1	·	·	·	+	·	·
Carex dolichostachya var. *glaberrima*	·	·	·	·	·	+	·	·	·	·	·
Hylocomium pyrenaicum	·	·	·	·	·	·	+.2	·	·	·	·
Trachycystis flagellaris	·	·	·	·	·	+	·	·	·	·	·
Transgressive species from the submontane oak forest											
Rhus trichocarpa	·	1.1	1.1	+.2	+	+	·	+	+.2	1.2	2.2
Vaccinium japonicum	·	·	2.2	1.1	+	+.2	+.2	+	2.2	2.2	1.1
Ilex crenata var. *paludosa*	·	·	1.1	+.2	2.2	1.1	1.2	·	2.2	1.1	1.1
Hamamelis japonica var. *obtusata*	·	+	2.2	·	1.2	2.2	+.2	2.2	1.2	2.2	+.2
Mitchella undulata	·	2.2	1.1	1.1	1.2	·	·	·	1.2	+.2	1.1
Rhus ambigua	1.2	·	·	·	+	+	+	·	·	1.2	+.2
Clethra barbinervis	·	·	+	·	·	·	2.2	2.3	+	·	·
Disporum smilacinum	·	·	·	·	·	·	·	·	2.2	·	·
Schizophragma hydrangeoides	·	·	·	+	·	·	·	·	·	·	·
Quercus mongolica var. *grosseserrata*	·	·	·	·	·	+.2	·	·	·	·	·
Fraxinus lanuginosa	·	·	·	·	·	+.2	·	·	·	·	·
Moisture elements											
Thamnobryum alopecurum	·	·	·	·	·	·	·	+	·	·	·
Dry elements											
Leucobryum neilgherrense	·	+.2	·	·	·	·	·	·	·	·	·
Heloniopsis orientalis	·	·	·	+	·	·	·	·	·	·	·
Shortia uniflora	·	·	·	·	·	·	·	4.4	·	·	·
Tripetaleia paniculata	·	·	2.2	·	·	·	·	·	·	·	·
Companions											
Fauriella tenuis	+.2	+	+.2	1.1	+	+	·	+	+.2	1.1	1.1
Hydrangea paniculata	·	+.2	·	+.2	+	+	+	1.2	+.2	+	1.2
Oxalis griffithii	+	+.2	·	·	+	+	+.2	+.2	+	+.2	+.2
Tripterospermum japonicum	1.1	+.2	·	·	·	·	·	·	+	+	·
Brachythecium populeum	·	+	·	·	+	·	+	·	·	·	·
Drepanocladus uncinatus	·	+	·	·	·	·	·	·	·	+	·
Thuidium kanedae	·	+	·	·	·	+	·	·	·	·	·
Oplopanax japonicus	·	·	·	·	+	·	·	1.2	·	·	·
Smilacina yesoensis	+	·	·	·	·	·	+.2	·	·	·	·
Hypnum oldhamii	+	·	·	·	·	·	·	·	·	·	·
Dryopteris austriaca	·	·	·	+	·	·	·	·	·	·	·
Solidago virga-aurea var. *asiatica*	+.2	·	·	·	·	·	·	·	·	·	·
Monotropastrum globosum	·	·	+	·	·	·	·	·	·	·	·
Kalopanax pictus	·	·	·	·	·	·	·	+	·	·	·
Leucothoe grayana var. *oblongifolia*	·	·	·	·	·	·	·	·	·	·	+
Enkianthus campanulatus	·	·	·	·	·	·	·	·	·	·	+
Anomodon rugelii var. *rugelii*	·	·	·	·	·	+.2	·	·	·	·	·
Schwetschkeopsis fobronia	·	·	+	·	·	·	·	·	·	·	·
Homalia japonica	·	·	+.2	·	·	·	·	·	·	·	·
Thuidium bipinnatulum	·	·	·	·	·	·	·	+	·	·	·
Dicranodontium denudatum	·	·	·	·	·	·	·	+	·	·	·
Rhododendron brachycarpum	·	·	·	·	·	·	·	+.2	·	·	·
Brotherella henonii	·	·	·	·	·	·	·	1.1	·	·	·
Corylus sieboldiana	·	·	·	·	·	·	+	·	·	·	·
Athyrium squamigerum	·	·	·	·	·	+	·	·	·	·	·

Differential species: *Ilex sugerokii* var. *brevipedunculata, Acer sieboldianum, Smilacina japonica, Prunus grayana, Daphniphyllum macropodum* var. *humile, Sorbus alnifolia, Osmunda asiatica, Lycopodium obscurum, Athyrium yokoscense.*

Occurrence of this variant is restricted to the eastern part of Mt. Hakusan. It occupies the middle part of the beech forest zone. Its typical stands are generally found around moors where soil is mesic with heavy snowdrifts. Its floristic composition is characterized by a large number of character species and constituent species of the association. The upper herb layer of this variant is composed of *Osmunda asiatica, Rumohra mutica* and *Plagiogyria matsumureana.*

Classification of Soil Types of the Beech Forest on Mt. Hakusan

In this study, the soils were classified after the scheme of the Government Forest Experiment Station of Japan, prepared by Forest Soils Division (1975). In the beech forest of Mt. Hakusan, 2 soil groups, 5 soil subgroups, 13 soil types, 1 soil subtype are recognized as shown in Table 11.

Table 11. Classification of the soil type of the beech forest on Mt. Hakusan

Soil group	Soil subgroup	Soil type	Soil subtype	Mode of deposition
I. Podzolic soils (P)				
	A. Dry podzolic soils (P_D)			
		1. Dry podzol (P_D I)		residual
		2. Dry podzolic soil (P_D II)		residual
		3. Dry slightly podzolic soil (P_D III)		residual
	B. Wet iron podzolic soils (Pw(i))			
		1. Wet iron podzol (Pw(i) I)		residual
		2. Wet iron podzolic soil (Pw(i) II)		residual
		3. Wet iron slightly podzolic soil (Pw(i) III)		residual
	C. Wet humus podzolic soils (Pw(h))			
		1. Wet humus slightly podzolic soil (Pw(h) III)		residual
II. Brown forest soils (B)				
	A. Brown forest soils (B)			
		1. Dry brown forest soil (loose granular structure type) (B_A)		residual
		2. Dry brown forest soil (granular and nutty structure type) (B_B)		residual deluvial
		3. Moderately moist brown forest soil (B_D)		residual deluvial
			a. Moderately moist brown forest soil (drier subtype) (B_{Dd})	residual deluvial
		4. Slightly wetted brown forest soil (B_E)		colluvial
		5. Wet brown forest soil (B_F)		colluvial
	B. Surface gleyed brown forest soils (gB)			
		1. Moderately moist surface gleyed brown forest soil (gB_D)		residual

I. Soil group: Podzolic soils (P)

Soils of this group develop widely in the alpine and subalpine zones of Mt. Hakusan as a representative zonal soil. They are also found in the montane zone, where, however, they are restricted to particular topographical sites. The soil generally has well-developed A_0, eluvial and illuvial horizons. The mode of deposition is always residual.

This group is subdivided into three subgroups based on the conditions of both moving water and humus: Dry podzolic, Wet iron podzolic and Wet humus podzolic soils.

I-A. Soil subgroup: Dry podzolic soils (P_D)

This subgroup is distributed above 900 m where it occurs on ridges, the upper part of steep slopes, edges of plateau and more or less convex topography at the middle part of steep slopes. The habitats are commonly associated with intense wind exposure, light snow accumulation, and a high rate of insolation. In such habitats, the A_0 horizon is well developed. All horizons except the top horizon contain many angulated stones or rocks and many pores. Transition of the horizon is always distinct, and fine roots are concentrated above the A_1 horizon. Loose-granular and granular structures which indicate dry condition are formed above the B_1 horizon, but the B_2 horizon does not show any strong structure.

This subgroup is further divided into the following three soil types based on the degree of the eluvial horizon development.

I-A-1. Soil type: Dry podzol (P_DI)
Altitudinal range: 900–1420 m.
Number of stands: 9.

Dry podzol (P_DI)

Site: Gifu Prefecture, Ohno-gun, Shirakawa-mura, Mt. Sanpoiwadake, 1280 m alt., S30°W, 45°; quadrat no. HC 71; mode of deposition: residual.

Horizon	Depth (cm)	Description
L	7–3	Composed almost completely of fallen branchlets and leaves of beech, mixed with some needles of *Pinus parviflora*.
F	3–0	Half decomposed litter, dark reddish brown (5YR 3/2), felty; fine roots abundant.
HA_1	0–3	Black (7.5YR2/1), clay-textured, humose, crumb-granular-structured, slightly wet; organic matter rich; fine roots many; sharply changing to A_2; pH 3.65; water content 66.8%.
A_2	3–9	Strongly bleached silt, grayish brown (7.5YR4/2), granular-structured, soft, slightly wet; organic matter poor; roots abundant; containing angulated whitish stones, sharply changing to B_1; pH 3.85; water content 48.6%.
B_1	9–22	Clay-loam, dark reddish brown (5YR3/3), poor in organic matter, blocky-structured, compact, moist, with iron deposition and few roots, sharply changing to B_2; pH 4.50; water content 34.3%.
B_2	22–55+	Clay, bright reddish brown (7.5YR5/6), with numerous larger stones, blocky-structured, poor in organic matter, with few roots; pH 5.40; water content 47.0%.

This soil type notably shows the vertical water movement, as reflected by the distinct leached A_2 horizon and the well-developed illuvial B_1 horizon. The A_1 horizon is comparatively thin, but occasionally attains 10 cm thick.

I-A-2. Soil type: Dry podzolic soil (P_DII)

Altitudinal range: 780–1260 m.
Number of stands: 5.

Dry podzolic soil (P_DII)

Site: Ishikawa Prefecture, Ishikawa-gun, Yoshinodani-mura, Mt. Kunimi dake; middle part of steep slopes; 780 m alt., N35°W, 50°; quadrat no. HC23; mode of deposition: residual.

Horizon	Depth (cm)	Description
L	9–4	Thick layer of litter consisting of beech leaves.
F	4–0	Half-decomposed litter; fine roots and micelia abundant; clearly changing to HA_1.
HA_1	0–3	Brownish black (5YR2/1), clay-textured, dried, loosely, granular-structured; organic matter rich; fine roots very abundant; sharply changing to A_2; pH 3.70; water content 62.4%.
A_2	3–4	Discontinuous eluvial horizon, grayish brown (7.5YR 4/2), silty-textured, moist; pore spaces abundant, organic matter poor, loose granular-structured; roots abundant; with angulated whitish stones, sharply changing to B_1; pH 4.20; water content 46.1%.
B_1	4–10	Illuvial horizon, dark brown (7.5YR 3/4), loamy-textured, slightly dried; pore spaces abundant; loose granular-structured; angulated rocks very abundant; roots abundant; sharply changing to B_2; pH 4.20; water content 46.1%.
B_2	10–55+	Structureless, brown (10YR 4/6), loamy-textured, slightly moist, no organic matter, few roots; angulated rocks very abundant; pH 4.50; water content 39.6%.

This type is characterized by the discontinuous or thin eluvial horizon, but the illuvial horizon B_1 is well developed in 4–10 cm depth. The A_0 horizon contains mycelia which indicate a dry soil condition, and all horizons predominantly show the loose-granular or the granular structure. These facts show that downward water movement is slightly weaker than in the preceding P_DI and a small amount of rain water may move along the slope.

I-A-3. Soil type: Dry slightly podzolic soil (P_DIII)
Altitudinal range: 1030–1300 m.
Number of stands: 7.

Dry slightly podzolic soil (P_DIII)

Site: Ishikawa Prefecture, Ishikawa-gun, Yoshinodani-mura, Chûgû-lane; ridge, 1300 m alt., S50°W, 30°; quadrat no. HB 59; mode of deposition: residual.

Horizon	Depth (cm)	Description
L	9–4	Matted leaves and fallen branchlets of beech.
F	4–1	Loose mat of partly decomposed leaves; fine roots abundant; containing cupules of beech; pore spaces many; mycelia abundant.
H	1–0	Reddish black (2.5YR 2/1); fine roots very abundant; pore spaces many; organic matter rich; merging into A.
A	0–7	Loam, brownish black (7.5YR 2/2), moist, granular-structured; organic matter rich; sharply changing to B_1; pH 4.00; water content 53.1%.
B_1	7–19	Iron-deposited horizon, very dark reddish brown (2.5YR 2/3), loamy-

		textured, moist, granular-structured; organic matter poor; roots abundant; large angulated stones rather numerous; more or less sharply changing to B_2; pH 5.00; water content 43.2%.
B_2	19–55+	Sandy loam, dark brown (10YR 3/4), moist, structureless; roots rare; angulated rocks abundant; pH 4.80; water content 22.7%.

Although this type has a distinct illuvial horizon, the development of the eluvial horizon is not recognizable. Only chemical analysis or microscopic examination enables to detect the eluviation phenomena (Ohmasa 1951). The other properties are fairly similar to those of the P_DII and the dry brown forest soil (B_A) in the Brown forest soil group.

I-B. Soil subgroup: Wet iron podzolic soils ($P_{w(i)}$)

In Mt. Hakusan, occurrence of this subgroup is restricted to the beech forest. Typical features include well-developed H or HA horizon, gleyed horizon and iron hard pan beneath the gleyed horizon. The development of massive structure of every horizons except the HA or A_1 is especially notable. Consequently drainage of those horizons is very poor. Well-developed example of this soil is found on the western part of Mt. Hakusan which is underlain with the Tedori group.

This subgroup is composed of the following three soil types which show different degrees of gleization in the surface horizon.

I-B-1. Soil type: Wet iron podzol ($P_{w(i)}$I)
Altitudinal range: 1190–1420 m.
Number of stands: 6.

Wet iron podzol ($P_{w(i)}$I)

Site: Ishikawa Prefecture, Ishikawa-gun, Shiramine-mura, Mt. Shakadake national forest, flat ridge; 1370 m alt., S40°W, 10°; quadrat no. HD 32; mode of deposition: residual.

Horizon	Depth (cm)	Description
L	6–3	Almost purely composed of fallen branchlets and leaves of beech.
F	3–0	Half-decomposed litter; fine roots abundant; mycelia abundant; sharply changing to HA_1.
HA_1	0–18	Black (7.5YR 2/1), heavy clay-textured, dried, dense and firm; organic matter rich; fine roots abundant; crumb-structured; sharply changing to A_2g; pH 4.15; water content 61.9%.
A_2g	18–21	Reduced horizon, light gray (10YR 7/1), heavy clay-textured, moist, compact, massive-structured; roots occasional; organic matter poor; containing cracks including organic matter of the HA_1 horizon, sharply changing to iron pan; pH 3.90; water content 30.5%.
Iron pan	21–22	Dark reddish brown (5YR 3/6); roots absent; very compact, containing impermeable horizon, sharply changing to B_1.
B_1	22–37	Bright brown (7.5YR 5/6), heavy clay-textured, moist; organic matter poor; massive-structured, compact; roots absent; merging to B_2; pH 3.80; water content 38.2%.
B_2	37–65+	Orange (7.5YR 6/6), heavy clay-textured, moist; organic matter poor; massive-structured; roots absent; angulated rocks frequent; pH 4.20; water content 31.7%.

This is the most typical soil which shows the gleization in the surface horizon. It usually occurs on flat ridges, or sometimes on flat topography or on the middle part of gentle slopes. Generally, the H horizon is greasy and is hardly distinguished from the well-developed A_1. In many cases, the upper part of the HA_1 or A_1 horizon is occupied by crumb or granular structure. Fine roots are restricted to this horizon. The A_2g* horizon shows massive structure and varies in depth from 2 to 20 cm. It sometimes contains cracks with vertical stripes of humus stained brownish black. The lower part of this horizon is light grey to dull yellow-orange and clearly distinguished from the B_1 horizon.

I-B-2. Soil type: Wet iron podzolic soil ($P_{w(i)}$II)
Altitudinal range: 1190–1410 m.
Number of stands: 7.

Wet iron podzolic soil ($P_{w(i)}$II)

Site: Ishikawa Prefecture, Ishikawa-gun, Shiramine-mura, Mt. Shakadake national forest, flat site at the middle part of a slope; 1225 m alt., S45°W, 15°; quadrat no. HB 19; mode of deposition: residual.

Horizon	Depth (cm)	Description
L	6–2	Thick horizon of litter consisting chiefly of beech leaves and branchlets.
F	2–0	Finely disintegrated leaves, with abundant fine roots.
HA_1	0–5	Intermingled with H horizon and hardly differentiated, brownish black (5YR 2/1), aggregates densely and firmly, clay-textured, slightly wet; organic matter very rich; crumb-structured; fine roots very abundant; clearly changing to A_2; pH 3.60; water content 78.5%.
A_2	5–13	Slightly reduced horizon, grayish brown (7.5YR 4/2), loamy-textured, slightly compact, moist; partly including few faint grey mottles (dull brown 7.5YR 6/3), and few orange mottles in B_1, massive-structured; organic matter poor; roots abundant; clearly changing to B_1; pH 3.70; water content 31.3%.
B_1	13–28	Orange (7.5YR 6/8), clay-loamy-textured, moist, compact, with few faint brownish black mottles in part, massive-structured, lacking organic matter; roots few; clearly changing to B_2; pH 4.30; water content 25.2%.
B_2	28–52+	Sandy loam, yellow orange (7.5YR 8/8), moist, compact, massive-structured, no organic matter; roots rare; pH 4.00; water content 21.5%.

This soil type develops in the middle part of gentle slopes or on the elevated sites around a moor. This is characterized by the A_2 horizon showing slight gleization with faint grey and orange mottles. The habitat and the feature of the profile suggest somewhat better drainage than in the $P_{w(i)}$I.

I-B-3. Soil type: Wet iron slightly podzolic soil ($P_{w(i)}$III)
Altitudinal range: 1130–1420 m.
Number of stands: 6.

* means gleization of the A_2 horizon.

Wet iron slightly podzolic soil ($P_{w(i)}$III)

Site: Gifu Prefecture, Ohno-gun, Shirakawa-mura, Amou-pass; elevated site of the edge surrounding a moor; 1420 m alt., S35°W, 5°; quadrat no. HC 54; mode of deposition: residual.

Horizon	Depth (cm)	Description
L	10–7	Mat of leaves and branchlets of beech and *Sasa kurilensis*.
F	7–5	Partly decomposed plant material, soft; fine roots abundant.
H	5–0	Thick humus horizon, greasy and soft; fine roots very abundant; clearly chaging to A_1.
A_1	0–10	Black (7.5YR 2/1), loamy-textured, greasy, wet, dense and firm, crumb-structured; organic matter rich; fine roots abundant; sharply changing to A_2; pH 3.90; water content 69.9%.
A_2	10–19	Dark brown (7.5YR 3/3), clay-textured, slightly wet, slightly compact, blocky-structured; organic matter moderate; roots few; angulated stones few; sharply changing to B; pH 4.25; water content 60.5%.
B	19–62+	Bright yellowish brown (10YR 6/6), clay-textured, slightly compact, moist, massive-structured; no organic matter; roots rare; angulated stones few; pH 4.50; water content 43.5%.

This is also a type characterized by the sign of gleization in the surface horizon. In many cases, there is no greyish A_2 horizon, but a thin dark brown A_2 horizon is rarely seen. It is the driest type in this subgroup, with the following characteristics: 1) A_1 and A_2 are composed of granular structure, and 2) often the upper part of the B_1 shows nutty structure. Although the feature of horizons are similar to soil type B_B of the Brown forest soil subgroup, this type is distinguished from that soil type by the thicker H horizon and B horizon with light color. It occurs on gentle slopes in contact with the preceding two types.

I-C. Soil subgroup: Wet humus podzolic soils ($P_{w(h)}$)

This subgroup is characteristic to the subalpine forest in Japan, e.g. the birch-fir forest in Mt. Hakusan. This subgroup is subdivided into three soil types with different eluvial horizons: $P_{w(h)}$I, II and III. In the beech forest of Mt. Hakusan, this subgroup is represented only by $P_{w(h)}$III which is the weakest in the development of eluvial and illuvial horizons.

I-C-1. Soil type: Wet humus slightly podzolic soil ($P_{w(h)}$III)
Altitudinal range: 1520–1650 m.
Number of stands: 5.

Wet humus slightly podzolic soil ($P_{w(h)}$III)

Site: Ishikawa Prefecture, Ishikawa-gun, Shiramine-mura, Mt. Rokumanzan; 1650 m alt., S20°E, 20°; quadrat no. HD 45; mode of deposition: residual.

Horizon	Depth (cm)	Description
L	9–6	Consisting chiefly of beech and *Sasa kurilensis* leaves.
F	6–3	Half-decomposed litter; fine roots and rhizomes of *Sasa kurilensis* abundant.
H	3–0	Very dark reddish brown (5YR 2/3), soft; pore spaces abundant, slightly wet; roots abundant; clearly changing to A_1.
A_1	0–4	Brownish black (5YR 2/1), clay-textured, moist, soft; organic matter

		very rich; granular-structured; fine roots and rhizomes of *Sasa kurilensis* very abundant; gradually changing to A_2; pH 4.40, water content 70.0%.
A_2	4–16	Heavy clay, brownish black (7.5YR 2/2), slightly compact, moist; granular and blocky-structured; organic matter rich; rhizomes of *Sasa kurilensis* abundant; clearly changing to A_2B; pH 4.40; water content 66.5%.
A_2B	16–62+	Brownish black (10YR 2/3), heavy clay-textured, compact, moist, blocky-structured; organic matter moderate; rhizomes of *Sasa kurilensis* abundant, brown mottles (10YR 4/4) slightly prominent; pH 4.20; water content 60.7%.

This is a podzolic soil, although we could not find eluvial and illuvial horizons because of penetration of humic substances to deeper solum. Occurrence of this soil type in the beech forest is restricted to the upper limit area, usually above 1500 m. The eluvial horizon is unrecognizable. The A_2B or B horizon is dotted with macles of sesquioxides.

II. Soil group: Brown forest soils (B)

This group represents a zonal soil in contact with the Podzolic soil group in the lower part of the subalpine zone. It is widely distributed in the temperate zone of Mt. Hakusan. It occurs in the submontane zone, too. This soil group differs from the Podzolic soil group by having no eluvial and illuvial horizons and is characterized by A horizon showing black or brownish-black and B horizon of brown color. According to Forest Soils Division of the Government Forest Experiment Station of Japan (1975), this group is divided into five subgroups: Brown-, Dark brown-, Reddish brown-, Yellowish brown- and Surface gleyed brown forest soils. The Reddish brown- and Yellowish brown forest soils do not exist in the beech forest of Mt. Hakusan. Between the subgroups Brown and Dark brown forest soils, there is only a small difference in soil sprofile except the color of each horizon. Consequently, in the present investigation, they were treated as a single subgroup (Brown forest soil subgroup).

II-A. Soil subgroup: Brown forest soils (B)

This includes six soil types and one subtype. In Mt. Hakusan, all types except B_C type widely develop in their respective habitats.

II-A-1. Soil type: Dry brown forest soil (loose granular structure type) (B_A)
Altitudinal range: 750–1070 m.
Number of stands: 5.

Dry brown forest soil (loose granular structure type) (B_A)

Site: Ishikawa Prefecture, Ishikawa-gun, Yoshinodani-mura, Mt. Kunimidake; ridge; 1030 m alt., S60°W, 45°; quadrat No. HC 13; mode of deposition: residual.

Horizon	Depth (cm)	Description
L	12–7	Nearly purely composed of fallen branchlets and leaves of beech, mixed in some needles of *Pinus parviflora*.

F	7–5	Pore spaces many, finely disintegrated leaves; mycelia present; fine roots abundant.
H	5–0	Thick horizon of fine humus, dark brown (7.5YR 3/3); pore spaces many; mycelia well-developed between this and A horizons; fine roots very abundant; gradually merging to A.
A	0–3	Brownish black (7.5YR 3/2), loamy-textured; dried, fine roots abundant; pore spaces many; mycelia present; organic matter rich; loose granular-structured, sharply changing to B_1; pH 4.00; water content 38.1%.
B_1	3–30	Loose-granular-structured, yellowish brown (10YR 5/6), loamy-textured; pore spaces many; dried, organic matter poor; roots few; angulated rocks few; gradually merging to B_2; pH 4.70; water content 19.1%.
B_2	30–60+	Loose granular-structured, brown (10YR 4/6), loamy-textured, dried; pore spaces many; organic matter poor; roots rare; angulated rocks abundant; pH 4.80; water content 12.1%.

Distribution of this type is concentrated in the upper part of steep slopes and ridges facing valleys, where the sites are usually exposed to the strong wind from the valley and intense solar radiation during the growing season. Loose-granular structure is well-developed toward the lower horizons, and all horizons show evident dryness. The brownish-black A horizon, where most of the fine roots are concentrated, is thin. Mycelia develop into the B horizon. The mode of deposition is residual. All horizons contain many pore spaces and large amount of angulated stones and rocks.

II-A-2. Soil type: Dry brown forest soil (granular and nutty structure type) (B_B)

Altitudinal range: 800–1300 m.

Number of stands: 31.

Dry brown forest soil (granular and nutty structure type) (B_B)

Site: Gifu Prefecture, Ohno-gun, Shirakawa-mura, Amou-pass; ridge, 1300 m alt., N25°W, 15°; quadrat no. HC 55; mode of deposition: residual.

Horizon	Depth (cm)	Description
L	12–8	Dead leaves and branchlets of beech and *Sasa kurilensis*.
F	8–4	Matted horizon of partly broken leaves, intermingled with finely decomposed organic matter; fine roots and rhizomes of *Sasa kurilensis* abundant.
H	4–0	Finely broken leaves; pore spaces many; fine roots very abundant; merging to A.
A	0–4	Brownish black (5YR 2/2), clay-textured, slightly wet, loose; organic matter rich; granular-structured; fine roots abundant; sharply changing to AB; pH 4.10; water content 74.9%.
AB	4–18	Brown (7.5YR 4/4), clay-textured, moist, dense and firm, blocky-structured, granular in part; roots many; organic matter moderate; sharply changing to B; pH 4.10; water content 63.9%.
B	18–55+	Brown (10YR 4/6), clay-textured, compact, slightly wet, massive-structured; organic matter poor; roots rare; pH 4.60; water content 54.8%.

The occurrence of this type is restricted to ridges or steep slopes. These sites are topographically similar to those of the preceding B_A soil type. The brownish-black A horizon develops more strongly than in the B_A soil type. This type is clearly subdivided into two modes of deposition: deluvial and residual. The former rarely appears on the elevated site of the middle part of slopes; the granular structure usually develop toward the lower horizons, sometimes the nutty structure in the upper part of the B horizon. Many roundish stones usually present in all horizon. The latter mode is characterized by the development of the massive or blocky structure in the AB and B horizons. This mode represents a greater part of this soil type in Mt. Hakusan, and seldom lies in contact with the $P_{w(i)}$ III.

II-A-3. Soil type: Moderately moist brown forest soil (B_D)
Altitudinal range: 940–1650 m.
Number of stands: 24.

Moderately moist brown forest soil (B_D)

Site: Gifu Prefecture, Ohno-gun, Shirakwa-mura, Ohshirakawa national forest, Hirase lane; middle part of the slopes; 1560 m alt., S40°W, 25°; quadrat no. HC 50; mode of deposition: residual.

Horizon	Depth (cm)	Description
L	6–2	Thick layer of litter consisting chiefly of beech leaves and branchlets.
F	2–0	Finely divided litter; cavities many; humid, absorbing roots very abundant; sharply changing to A_1.
A_1	0–5	Brownish black (7.5YR2/2), clay-textured, humid, loose, crumb-structured; organic matter rich; absorbing roots abundant; angulated stones few; merging to A_2; pH 4.40; water content 60.8%.
A_2	5–35	Clay-textured, dark brown (10YT3/3), humid, compact, blocky-structured; organic matter moderate; roots few, roots channels present; containing angulated rocks; clearly changing to B_1; pH 5.05; water content 44.1%.
B_1	35–65+	Yellowish brown (10YR5/6), clay-textured, humid, compact, massive-structured; organic matter poor; roots rare; containing angulated rocks; pH 5.50; water contant 35.8%.

This soil type develops at the middle or lower part of slopes and on flat sites. In the profile, the horizons show gradual change with obscure boundaries. The A_0 horizon is poorly developed and usually lacks H horizon. The A horizon of crumb structure is 30–50 cm thick. It is divided into two horizons: brownish black A_1 and dark brown A_2 horizons. This type is clearly subdivided into two modes of deposition, deluvial and residual. The residual occurs on the upper part of gentle slopes or flat sites. Its profile shows a heavy clayey texture and a blocky or massive structure in the B horizon and rarely includes stones. The deluvial well develops on the middle or lower part of slopes and shows loam or clay-loam texture containing many slightly roundish stones in each horizon. Movement of water in this kind of soils is easier than in the former, and the water is not stagnant. In many cases, the soil of this type adjoins the B_E soil

type.

II-A-3-a. Soil subtype: Moderately moist brown forest soil (drier subtype) ($B_{D(d)}$)
Altitudinal range: 800–1700 m.
Number of stands: 8.

Moderately moist brown forest soil (drier subtype) ($B_{D(d)}$)

Site: Toyama Prefecture, Higashitonami-gun, Kamitaira-mura, Bunao-pass; ridge; 1040 m alt., N40°E, 30°; quadrat no. HD 15; mode of deposition: residual.

Horizon	Depth (cm)	Description
L	8–4	Consisting chiefly of beech leaves and branchlets.
F	4–2	Matted horizon of partly broken leaves; pore spaces many; slightly wet; fine roots abundant.
H	2–0	Brownish black (5YR 2/2), clay-textured, in some places intermingled with A_1, loose, moist, granular-structured in part; organic matter rich; fine roots abundant; sharply changing to A_1.
A_1	0–11	Dark brown (10YR 3/3), clay-textured, dense and firm, moist, granular-structured, blocky-structured in part; organic matter rich; fine roots abundant; merging to A_2; pH 4.30; water content 53.0%.
A_2	11–28	Heavy clay, brown (7.5YR 4/4), slightly compact, moist, blocky-structured, granular-structured in part; organic matter moderate; roots abundant; clearly changing to B; pH 4.50; water content 50.2%.
B	28–66+	Brown (10YR 4/6), heavy clay in texture, compact, moist, massive-structured, blocky-structured in the upper part; organic matter poor; roots rare; pH 4.80; water content 52.9%.

The depth of the A horizon and other features of this subtype are similar to the mother soil type B_D. However, the significant differences are as follows: H horizon develops weakly and the top soil is characterized by the granular structure which indicates the dry condition. In the field, it sometimes lies in contact with the B_B soil type in the upper and with the B_D type in the middle or lower part of slopes. Although the structure of each horizon is similar to that of the preceding soil type B_B, the depth of the A horizon and the habitat are different. Different modes of deposition are recognized by the rate of different stoniness in the profile, though the difference of modes is less clear than in the mother type.

II-A-4. Soil type: Slightly wetted brown forest soil (B_E)
Altitudinal range: 940–1380 m.
Number of stands: 12.

Slightly wetted brown forest soil (B_E)

Site: Gifu Prefecture, Ohno-gun, Shirakawa-mura, Ohshirakawa national forest; lower part of the slope; 940 m alt., S15°W, 10°; quadrat no. MS 8; mode of deposition: colluvial.

Horizon	Depth (cm)	Description
L	4–2	Loose horizon of dead leaves and branchlets of beech, horse chestnut and *Sasa kurilensis*.

F	2–0	Finely decomposed litter; pore spaces many; fine roots abundant.
A_1	0–10	Brownish black (5YR 2/1), clay-textured, loose, moist, crumb-structured; organic matter very rich; roots abundant; with angulated stones, gradually merging to A_2; pH 4.55; water content 54.3%.
A_2	10–35	Sandy loam, brownish black (5YR 3/2), dense and firm, moist, blocky-structured, crumb-structured in part; organic matter rich; roots occasional; angulated stones many; gradually merging to A_2B; pH 4.75; water content 44.1%.
A_2B	35–75+	Gravelly horizon with loam, brown (10YR 4/4), compact, moist, structureless; organic matter moderate; roots rare; angulated rocks abundant; pH 5.20; water content 20.0%.

This type usually develops in the lower part of slopes, falt sites along the rivulet and rarely on the middle of steep slopes. These are the sites receiving an intense supply of organic matter and water including nutrient salts. In the profile, H horizon does not develop. On the contrary, the development of the A horizon is very well, usually attaining over 50 cm in depth. The brownish black or dark brown A horizon is characterized by the development of crumb structure and is subdivided into three horizons by color, texture and structure: A_1, A_2 and A_2B. The movement of water in soil is very well toward the lower horizons containing abundant pore spaces and stones. The mode of deposition is colluvial. At the middle part of steep slopes, the A horizon shows the granular structure which indicates drier conditions than in the lower sites.

II-A-5. Soil type: Wet brown forest soil (B_F)
Altitudinal range: 1200, 1250 m.
Number of stands: 2.

Wet brown forest soil (B_F)

Site: Ishikawa Prefecture, Ishikawa-gun, Oguchi-mura, Maruishidani; lower part of a slope; 1250 m alt., S80°W, 5°; quadrat no. HD 53; mode of deposition: colluvial.

Horizon	Depth (cm)	Description
L	8–6	Mostly dead leaves of beech and *Sasa kurilensis*.
F	6–3	Half-decomposed litter; fine roots abundant.
H	3–0	Matted horizon of humus, brownish black (5YR 2/2); fine roots very abundant; crumb-structured in part, gradually merging to A_1.
A_1	0–6	Brownish black (10YR 2/2), clay-textured, dense and firm, slightly wet, blocky-structured; organic matter rich; roots rare; sharply changing to A_2; pH 3.85; water content 65.5%.
A_2	6–9	Heavy clay, grayish brown (7.5YR 4/2), dense and firm, blocky-structured; organic matter moderate; no roots, sharply changing to buried A_1; pH 4.50; water content 61.0%.
Buried A_1	9–26	Brownish black (5YR 3/1), heavy clay-textured, dense and firm, wet, massive-structured; organic matter rich; clearly changing to buried A_2; pH 4.50; water content 73.5%.
Buried A_2	26–32	Brownish black (5YR 3/2), heavy clay-textured, moist, compact; organic matter moderate; no roots; massive-structured; clearly changing to iron pan; pH 4.00; water content 66.0%.

Iron pan	32–33	Reddish brown (5YR 4/6), compact, impermeable horizon, sharply changing to B.
B	33–58+	Dark brown (10YR 3/4), heavy clay-textured, moist, compact, massive-structured; organic matter poor; no roots; pH 4.55; water content 58.5%.

This type is observed in restricted areas at the flat site in the lower part of gentle slopes, and usually lies in contact with the preceding B_D-deluvial. The mode of deposition is colluvial sometimes having a buried A horizon. This may have been derived from the landslide in the past. The crumb-structured H horizon develops to a certain extent. It always has a well-developed A_0 horizon. Between the H and A_1 horizons there is no clear-cut difference in color, but the change is very clear in structure. Fine roots are most abundant in the H horizon and the upper part of the A_1 horizon. Weakly reduced A_2 horizon varies in depth from 3 to 10 cm and always changes distinctly to the lower horizon. The drainage in this soil type is very poor, which causes gleyed A_2 horizon.

II-B. Soil subgroup: Surface gleyed brown forest soils (gB)

With respect to the constitution of each horizon, this resembles the Brown forest soil subgroup, but it differs from that subgroup in the existence of a weakly reduced A_2g horizon. In the occurrence of the reduced A_2g horizon and the composition of the texture in each horizon, this is similar to the soil types, $P_{w(i)}I$, $P_{w(i)}II$ and B_F. It, however, is different from them in having weaker A_0 and A_1 horizons, and weaker and thiner reduced A_2g horizon. This subgroup includes four soil types, among which only one type is recognized in the investigated area.

II-B-1. Soil type: Moderately moist surface gleyed brown forest soil (gB_D)
Altitudinal range: 1190–1590 m.
Number of stands: 12.

Moderately moist surface gleyed brown forest soil (gB_D)

Site: Gifu Prefecture, Ohno-gun, Shirakawa-mura, Mt. Sanpoiwadake; flat ridge; 1240 m alt., N20°E, 10°; quadrat no. HC 57; mode of deposition: residual.

Horizon	Depth (cm)	Description
L	4–2	Almost perfectly composed of fallen branchlets and leaves of beech.
FH	2–0	Matted horizon of half-decomposed litter, intermingled with organic matter; fine roots very abundant; sharply changing to A_1.
A_1	0–1	Thin horizon, dark brown (7.5YR 3/3), clay-textured, soft, slightly wet, crumb-structured; organic matter moderate; roots very abundant; gradually merging to A_2g; pH 4.15; water content 65.2%.
A_2g	1–8	Slightly reduced horizon, grayish brown (5YR 4/2), clay-textured, slightly compact, moist, blocky-structured, crumb-structured in the upper part of the horizon; organic matter poor; roots occasional; sharply changing to B_1; pH 3.90; water content 51.6%.
B_1	8–28	Prominent brown mottles, bright brown (7.5YR 5/6), heavy clay-textured, no organic matter, massive-structured; roots rare; gradually

		merging to B_2; pH 4.70; water content 41.7%.
B_2	28–60+	Heavy clay, brown (7.5YR 4/6), moist, compact, massive-structured, no organic matter; no roots, with decaying roots; pH 4.85; water content 34.3%.

This type concentrates on flat topography of the middle part of gentle slopes, occasionally develops also on flat ridges. In the profile, clay texture is dominant, and a massive structure is well-developed below the B horizon. The feature of the profile except the gleyed A_2g horizon is similar to B_D. The A_1 horizon varies in depth from 1 cm on flat ridges to 7 cm on gentle slopes, and is usually crumb-structured. Penetration of fine roots is restricted to the A_1 horizon. Weakly gleyed A_2g horizon is 4–15 cm thick. In the upper part of B horizon, macles of sesquioxides are rarely recognized with dark reddish-brown color. The mode of deposition is represented by residual.

Interrelation between Vegetation Units and Soil Types

Parallelism between vegetation units and soil types

I. Plant associations and soil groups

Before entering into consideration of the parallelism between lower units of the association Lindero membranaceae-Fagetum crenatae and soil types, the relationship between the forest associations and soil groups observed in Mt. Hakusan is outlined (Table 12).

Table 12. Outline of the relationship between forest associations and soil groups on Mt. Hakusan

Association	Range of altitude (m)	Soil group
Abietum mariesii	1670–2500	Podzolic soils
Lindero membranaceae-Fagetum crenatae	400–1700	Brown forest soils & Podzolic soils
Rhodoreto-Thujetum	750–1760	Podzolic soils
Polysticho-Pterocaryetum	700–1210	Brown forest soils & Immature soils
Querco-Castanetum	360– 640	Brown forest soils

The Lindero membranaceae-Fagetum crenatae develops in areas of both Brown forest soil and Podzolic soil groups. Of the investigated stands of the association, 73.4 percent belong to the Brown forest soil group (Ref. nos. 5–14 in Table 13). This soil group, however, is seen also at lower altitudes under the forests of Querco-Castanetum and Polysticho-Pterocaryetum. According to Kovács (1975), the brown forest soil occurs in oak forests and beech forests in Europe. The Podzolic soil group is rather rare in the beech forest of Mt. Hakusan.

II. Lower units of the Lindero membranaceae-Fagetum crenatae and soil

types

Lower vegetation units such as subassociations, variants and subvariants correspond better to the soil types. Correlation between the vegetation unit and soil is summarized in Table 13.

A. Camellietosum

Related soil types: B_D, $B_{D(d)}$, B_B (Ref. nos. 9–13 in Table 13).

Number of the investigated stands: 12.

This subassociation is closely associated with the Brown forest soil subgroup. Most soils, except B_B-deluvial, have clayey texture in all horizons. The *Cephalotaxus harringtonia* var. *nana* variant is restricted to B_D and $B_{D(d)}$, but the Typical variant shows a wider range of soil preference.

B. Aesculetosum

Related soil types: B_F, B_E, B_D-deluvial (Ref. nos. 6–8 in Table 13).

Number of the investigated stands: 18.

This subassociation usually develops on moist and eutrophic B_E and B_D-deluvial soils, which are characterized by abundant stones and many pore spaces in the profile. The occurrence of the *Dryopteris austriaca* variant is restricted to B_F. The *Acer palmatum* var. *matsumurae* variant occurs only on B_E and B_D-deluvial.

C. Pinetosum

Related soil types: $B_{D(d)}$-, B_B-residual, B_A, P_DI, P_DII, P_DIII (Ref. nos. 10, 12, 15–17 in Table 13).

Number of the investigated stands: 18.

This subassociation develops mainly on dry podzolic soils (P_DI, II, III) and dry brown forest soils which indicate oligotrophic and dry soil condition. Its soil preference is similar to that of the Rhodoreto-Thujetum. This subassociation sometimes occurs on the edge of flat ridges. In such cases, the soil type is $B_{D(d)}$- and B_B-residual with a compact profile of heavy clay. The *Sasa kurilensis* variant is distributed on various soil types except B_A. The *Plagiogyria matsumureana* subvariant is restricted to soils of the Dry podzolic soil subgroup. The *Lyonia ovalifolia* var. *elliptica* variant occurs on soils of both the Dry podzolic soil subgroup and the B_A soil type, while the Typical subvariant is more frequent on the latter.

D. Cryptomerietosum

Related soil types: $P_{w(i)}I$, $P_{w(i)}II$, $P_{w(i)}III$, B_D, B_B-residual, P_DI (Ref. nos. 2–4, 8–12, 15 in Table 13).

Number of investigated stands: 27.

This subassociation is distributed widely on soils of various types, but each of the variants and subvariants shows its own preference to soil types. However, the common characteristic of the related soil types is heavy clay texture. These soil types are high in water holding capacity. The *Cornus canadensis* subvariant,

Table 13. Soil type preference of vegetation units of the beech forest on Mt. Hakusan; shown by the number of stands

		Reference No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
		Soil group	P(26.8%)				B(73.4%)										P			
		Soil subgroup	Pw(h) (3.0%)	Pw(i) (11.2%)			gB (7.1%)	B (66.3%)									Po (12.4%)			
		Soil type	III	I	II	III	gB_D	B_F	B_E	B_D				B_B		B_A	I	II	III	
		Subtype										$B_{B<d>}$								
		Mode of deposition*	r	r	r	r	r	c	c	d	r	r	d	r	d	r	r	r	r	
		Number of stand	5	6	7	6	12	2	12	13	11	19	19	28	3	5	9	5	7	Total
Subassociation	Variant	Subvariant																		
Camellietosum	Typical		.	.	.	.	.	.	.	.	1	1	1	2	1	.	.	.	.	6
	Cephalotaxus harringtonia var. *nana*		.	.	.	.	.	.	.	.	2	4	.	.	.	.	.	.	.	6
Aesculetosum	*Dryopteris austriaca*		.	.	.	.	.	2	2	1	.	.	.	.	.	.	.	.	.	5
	Acer palmatum var. *matsumurae*	*Pterocarya rhoifolia*	.	.	.	.	.	.	3	1	.	.	.	.	.	.	.	.	.	4
		Typical	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	5
		Cornus kousa	.	.	.	.	.	.	2	2	.	.	.	.	.	.	.	.	.	4
Pinetosum	*Sasa kurilensis*	Typical	.	.	.	.	.	.	.	.	.	3	.	1	.	.	2	.	.	6
		Plagiogyria matsumureana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	3
	Lyonia ovalifolia var. *elliptica*	*Chamaecyparis obtusa*	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	1	4
		Typical	.	.	.	.	.	.	.	.	.	.	.	.	.	4	1	.	.	5
Cryptomerietosum	*Mitchella undulata*	*Cornus canadensis*	.	3	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
		Typical	.	.	1	1	.	.	.	.	1	.	.	1	.	.	.	.	.	4
		Tripetaleia paniculata	.	1	2	1	.	.	.	.	1	2	2	4	.	.	.	.	.	13
	Rhododendron metternichii var. *hondoense*		.	.	1	.	.	.	.	.	.	.	.	.	.	.	4	.	.	5
Typical	Typical	Typical	.	.	.	1	.	.	.	.	.	2	.	1	.	.	.	.	.	4
		Maianthemum dilatatum	.	.	.	.	3	.	.	.	1	3	.	5	.	.	.	.	.	12
	Acer mono	Typical	.	.	.	.	.	.	.	2	1	1	2	3	.	.	.	.	.	9
		Acer palmatum var. *matsumurae*	.	.	.	.	.	.	.	5	1	1	4	2	2	.	.	.	.	15
Tripetaleietosum	Typical		.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	2	3	8
	Disporum smilacinum		.	.	.	.	.	.	.	.	.	.	3	6	.	.	.	1	2	12
Dryopteridetosum	Typical		.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	3
	Lindera umbellata var. *membranacea*	*Osmunda asiatica*	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	2
		Typical	.	.	.	.	4	.	.	1	1	.	.	.	.	.	.	.	.	6
		Cephalotaxus harringtonia var. *nana*	.	.	.	1	5	.	.	1	1	2	1	3	.	.	.	.	.	14
Abietetosum	*Carex morrowii* var. *temnolepis*	Typical	2	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	3
		Menziesia pentandra	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
	Ilex sugerokii var. *brevipedunculata*		.	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	3

* r = residual, c = colluvial, d = deluvial

which develops in a flat or at the margin of moor, is restricted to $P_{w(i)}I$ and $P_{w(i)}II$. On the contrary, the *Rhododendron metternichii* var. *hondoense* variant occurs mainly on P_DI and rarely on $P_{w(i)}II$ on a small ridge. The Typical and the *Tripetaleia paniculata* subvariants develop widely on two soil subgroups, i.e. the Wet iron podzolic and the Brown forest soils.

E. Typical subassociation

Related soil types: $P_{w(i)}III$, gB_D, B_D, $B_{D(d)}$, B_B (Ref. nos. 4, 5, 8–13 in Table 13).

Number of the investigated stands: 40.

This subassociation usually develops on brown forest soils, but neither on extremely dry nor wet soil types. Its occurrence is restricted to the habitats which are moderate in water and nutrient supply. The Typical variant occurs mainly on the residual soils with a wider range than the *Acer mono* variant. When the Typical variant lies in contact with the Dryopteridetosum, it has $P_{w(i)}III$ or gB_D. The *Acer mono* variant, which develops on slopes, occurs only on brown forest soils of mostly deluvial origin. This is the basic difference from those of the Typical variant.

F. Tripetaleietosum

Related soil types: $B_{D(d)}$-deluvial, B_B-residual, P_DII, P_DIII (Ref. nos. 11, 12, 16, 17 in Table 13).

Number of the investigated stands: 20.

This subassociation develops on the soils which have a dry surface horizon, but is not found in sites of the B_A and P_DI. It lies in between the Pinetosum and the Typical subassociation. The floristic composition is correlated with the soil pattern. Of the two variants, the Typical one is more frequent in sites of the Dry podzolic soils subgroup.

G. Dryopteridetosum

Related soil types: $P_{w(i)}I$, $P_{w(i)}III$, gB_D, B_D, $B_{D(d)}$, B_B-residual (Ref. nos. 2, 4, 8–12 in Table 13).

Number of the investigated stands: 25.

This subassociation occurs widely on brown forest and podzolic soils except in extremely dry or wet habitats. The Typical variant, which attains to the upper limit of the beech forest, develops only on the $B_{D(d)}$-deluvial. On the contrary, the *Lindera umbellata* var. *membranacea* variant occurs on various soil types with higher proportion of the oligotrophic and stagnant types ($P_{w(i)}I$, III, gB_D). The *Osmunda asiatica* subvariant is restricted to the wet iron podzolic soil. The Typical and the *Cephalotaxus harringtonia* var. *nana* subvariants have a similar soil preference and occur in the greater proportion of the gB_D soil type.

H. Abietetosum

Related soil types: $P_{w(h)}III$, $P_{w(i)}I$, $P_{w(i)}II$, $P_{w(i)}III$, B_D-residual (Ref. nos. 1–4, 9 in Table 13).

Number of the investigated stands: 9.

This subassociation occurs exclusively on podzolic soils. Soils of the two variants are clearly separated into two soil subgroups, both showing oligotrophy and poor drainage. The *Carex morrowii* var. *temnolepis* variant developing in contact with the subalpine birch-fir forest at higher altitudes, is characterized by $P_{w(i)}$III, and occasionally by B_D-residual. The *Ilex sugerokii* var. *brevipedunculata* variant occurring around moor at lower altitudes is characterized by the Wet iron podzolic soils subgroup.

The parallelism between vegetation units and soil types has clearly been shown. Vegetation units corresponding well to the soil types include subassociations, variants and some subvariants which occur in their respective extreme topographic or altitudinal condition. The vegetation units show a narrower soil preference. On the other hand, those which develop in flat sites or on slopes have a wider range in soil requirement. In the subassociations and lower units, topography plays the major role, which affects plant growth by the dynamic state of water: eluvial, stagnant, movable or accumulative. The following two groups of syntaxa are good examples of this tendency. (a) Such units occur only on wet iron podzolic soils (Ref. nos. 2–4 in Table 13) as *Cornus canadensis* subvariant of the Cryptomerietosum, *Osmunda asiatica* subvariant of the Dryopteridetosum and *Ilex sugerokii* var. *brevipedunculata* variant of the Abietetosum; (b) *Maianthemum dilatatum* subvariant of the Typical subassociation and *Cephalotaxus harringtonia* var. *nana* subvariant of the Dryopteridetosum prefer gB, $B_{D(d)}$- and B_B-residual soil types (Ref. nos. 5, 8–12 in Table 13). Although these syntaxa in the same category shown above are considerably different from each other in altitudinal range and floristic composition, their habitats show a close similarity in terms of topographic condition.

Ecological value of species as soil indicator

Soil preference of each species is presented in Table 14. The presence of the species is indicated by the percentage of the stands where the species occurred (in five classes I–V) and range of coverage is exponentially shown.

1. Character species of the Lindero membranaceae-Fagetum crenatae (Table 14)

Most of the character species grow well on B_D, $B_{D(d)}$ and B_B. Among these species, however, *Fagus crenata* and *Acer japonicum* do not show preference to any soil type and thus occur indifferently on both Podzolic and Brown forest soil groups. Other species are often lacking or rare on such soil types as B_F, B_E and $P_{w(h)}$III. The component species of the shrub and herb layers are rare or absent on the dry soil type B_A.

2. Transgressive species between the beech and the subalpine birch-fir forests (Table 14)

Species of this category, except *Viburnum furcatum,* are rare or lacking on mesic or dry soil types: B_F, B_E and B_A. In general, phanerogamous members of these species are remarkably predominant on wet podzolic soils, i.e. $P_{w(i)}$ and $P_{w(h)}$. Of them, *Menziesia pentandra, Acer tschonoskii* and *Maianthemum dilatatum* are especially pronounced in this respect. Furthermore, members of the lower herb layer are rare or lacking in sites of the Dry podzolic soil subgroup.

3. Transgressive species between the beech and the submontane oak forests (Table 14)

Not many species of this category occur on the $P_{w(h)}$III soil type. They never occur in the subalpine birch-fir forest. *Lindera umbellata* var. *membranacea* and *Rhus trichocarpa* are constantly occur throughout all the soil types. However, *Acer rufinerve, Aucuba japonica* var. *borealis, Rhus ambigua* and *Schizophragma hydrangeoides* are rare or lacking on the soil types B_A and the Dry podzolic soils subgroup. Other species of this category are rare or absent on the soil type B_E.

4. Species of moist soil elements (Table 14)

Species of this category are widely distributed on brown forest soils of both the beech and the oak forests. Therefore, we can infer presence of the Brown forest soil group from their occurrence. In the beech forest, these species grow luxuriantly on mesic or humid soil types: B_E, B_D-deluvial and gB_D, but somewhat rare on B_F. The soil preference is remarkable in species such as *Cephalotaxus harringtonia* var. *nana* and *Acer mono.* Thus the species group of this category indicates mesic or humid soil conditions.

5. Species of dry soil elements (Table 14)

Rhododendron nudipes, R. kaempferi and *Leucobryum neilgherrense* are usually found on drier soil types: B_A, P_DI, II, III, but occur less vigorously on $B_{D(d)}$. They are often lacking on B_D-deluvial. These species occur in sites of the particular topography. Thus, they indicate the oligotrophic and dry soil condition. On the other hand, *Tripetaleia paniculata, Menziesia multiflora, Shortia uniflora* and *Heloniopsis orientalis* are distributed more widely than the above species. Species of the latter group occur on the same soil types as the former group, and furthermore, they develop also on wet iron podzolic soils.

6. Differential species of the Camellietosum

This is represented by only one species, *Camellia rusticana.* Its occurrence is restricted to brown forest soils.

7. Differential species of the Aesculetosum

These species usually occur on B_F, B_E and B_D-deluvial. Vigorous growth of ferns suggests that nutrients are supplied by seepage water. The similar case was reported by K. Suzuki & Hukusima (1972) on the tall herb community in the subalpine zone of Mt. Hakusan.

8. Differential species of the Pinetosum

The differential species of this subassociation, which are coniferous or eri-

caceous, are characteristic to oligotrophic and drier soil types, i.e. B_A, P_DI, P_DII and P_DIII. The strong combination of the species with the particular soil types is remarkable.

9. Differential species of the Cryptomerietosum

Cryptomeria japonica occurs on wet iron podzolic soils showing stunted growth. According to Maeda & Miyagawa (1970), the optimum habitat of this species is found on the lower part of slopes or along the rivulet of the valley bottom where soil is rich in supply of water and nutrient salts. In the temperate zone, such habitat is occupied by *Aesculus trubinata, Pterocarya rhoifolia,* etc. Consequently *Cryptomeria japonica* is forced to grow on the site with wet iron podzolic soils which show a mesic and compact profile on flat topography. Its stunted growth may have been caused by the oligotrophic and weak stagnant water of those soil types. *Cryptomeria japonica* is regarded as an indicator of wet iron podzolic soils. *Viburnum urceolatum* var. *procumbens* shows also the similar preference for those soil types.

10. Differential species of the Tripetaleietosum

The differential species are composed of dry soil elements. Distributional ranges of these species are mostly wider than that of the subassociation itself.

11. Differential species of the Dryopteridetosum

The two differential species *Dryopteris austriaca* and *Smilacina yesoensis* occur on many soil types. Of the two, *Dryopteris austriaca* shows wider range than *Smilacina yesoensis,* and grows luxuriantly on gB_D and B_F soil types, which show weak stagnation. This is an apparent phenomenon of the Dryopteridetosum.

12. Differential species of the Abietetosum

The three differential species have narrow soil preference, occurring mainly on the Podzolic soil group. We can recognize that *Abies mariesii* is an indicator species of wet humus podzolic soils because of its preferential occurrence on the soil of $P_{w(h)}III$.

13. Differential species of variants and subvariants

Plectranthus kameba var. *hakusanensis, Pterocarya rhoifolia* and *Rumohra standishii* show the same soil preference as the differential species of the Aesculetosum, which grow luxuriantly on B_F and B_E. The occurrence of *Chamaecyparis obtusa, Ilex pedunculosa, Lyonia ovalifolia* var. *elliptica* and *Sorbus gracilis* resemble closely that of the differential species of the Pinetosum, usually occurring on B_A. *Rhododendron brachycarpum* in the Abietetosum and *Rhododendron metternichii* var. *hondoense* in the Cryptomerietosum are differential species of different vegetation units, but they are equally growing only on soils of the $P_{w(i)}III$ and P_DI types which are generally oligotrophic. *Osmunda asiatica* and *Athyrium yokoscense,* which are characteristic species of the lower units of the Abietetosum and the Dryopteridetosum, occur commonly but with low presence on wet iron podzolic soils.

The character species occur only in the beech forest, while other two trans-

gressive species groups are more widely distributed towards the upper or lower zone. They do not strictly indicate a preference to special soil type as shown in Table 14. The occurrence of these three species groups may be controlled mainly by temperature. Most of the differential species of the subassociations and a part of those of the variants and subvariants are effective indicator of soil condition. Similar combinations are found in both the moist and the dry soil elements as well as the differential species of the Aesculetosum and of the Pinetosum. Most species of these groups occur on several soil types showing the common features in soil water condition. In some cases, the differential species of vegetation units cover many soil types. There are, however, tendencies that on flat or gentle slopes they show a wider tolerance, while on the extreme topography they show a narrower preference.

Species of the undergrowth generally show narrower requirement for the soil type. This is most prominent in species of the herb layer. The fact may support the conclusion by Maeda & Miyagawa (1970) that the undergrowth reflects the transition of soil types.

Summary

1. The present study was undertaken to explain ecological relationships between vegetation units and soil types in the beech forest on Mt. Hakusan which is situated on the Japan Sea side of middle Honshu, Japan.

2. The study of vegetation follows the methodology of the Braun-Blanquet school of phytosociology. The phytosociological data were arranged into a phytosociological system of the association Lindero membranaceae-Fagetum crenatae Sasaki 1970. Character species of the association in Mt. Hakusan were decided by a comparison of the floristic composition between the beech and the neighboring forests of the mountain. The association was subdivided into 8 subassociations including 16 variants and 19 subvariants.

3. The soil profiles were classified into 2 soil groups, 5 soil subgroups and 13 soil types including one subtype according to the Forest Soils Division of the Government Forest Experiment Station of Japan. The soil type was further subdivided by the mode of deposition. The water condition and physical properties of each soil were examined.

4. The association Lindero membranaceae-Fagetum crenatae of Mt. Hakusan covers two soil groups: the Podzolic and the Brown forest soils. The Brown forest soils form the major portion of the soil types. Vegetation units corresponding well to the soil types include subassociations, variants and some subvariants which occur in their respective extreme topographic or altitudinal conditions. They show a narrower soil preference. On the other hand, vegetation units which develops in flat sites or slopes have a wider range in soil requirement.

5. The character species of the association and two transgressive species

groups have a wider soil preference. The species groups: two elements (moisture and dry) and differential species of subassociations, variants and a part of subvariants, are effective indicator of soil condition. They occur on several soil types, showing the common features in soil water condition, caused by the difference of topography, such as eluvial, movable, accumulative and stagnant.

6. The occurrence of the association seems to be determined mainly by the thermal conditions, while that of subassociations, variants and subvariants by the topographic and altitudinal conditions. Especially, the water condition is the most important factor, inducing both special combination of species and formation of soil types in the beech forest on Mt. Hakusan.

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Plate V

Fig. 1. A typical stand of the Camellietosum at Bunao-pass in Toyama Prefecture. The undergrowth is characterized by the luxuriant growth of evergreen and creeping *Camellia rusticana*. (1050 m alt.; 8. VI. 1975)

Fig. 2. *Camellia rusticana* in the upper shrub layer of the Camellietosum. (1020 m alt.; 8. VI. 1975)

Fig. 3. A stand of the Cryptomerietosum in Shakadake national forest, Ishikawa Prefecture. The physiognomy of this subassociation is characterized by the contrast between *Cryptomeria japonica* and *Fagus crenata* in the canopy. (1235 m alt.; 24. VII. 1975)

Fig. 4. A close view of the lower herb layer dominated by *Cornus canadensis* with litters of *Cryptomeria japonica*. (1300 m alt.; 25. VII. 1975)

Fig. 5. A typical stand of the Pinetosum on Mt. Kunimidake, Ishikawa Prefetcure. *Pinus parviflora* is associated with *Fagus crenata* in the canopy. (980 m alt.; 8. VIII. 1974)

Fig. 6. A stand of the typical subassociation. Trunks of beech trees are covered with lichen and bryophyte communities. (1500 m alt.; 30. IX. 1974)

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4

5

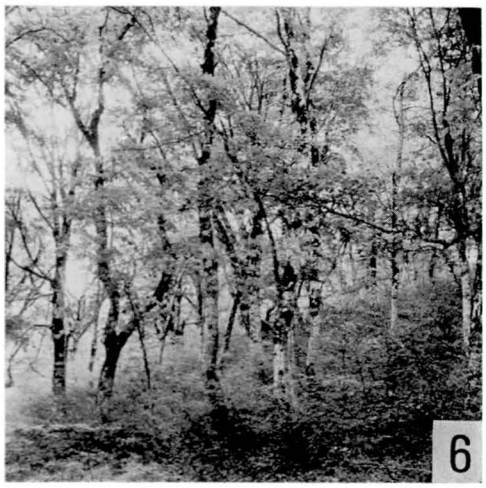

6

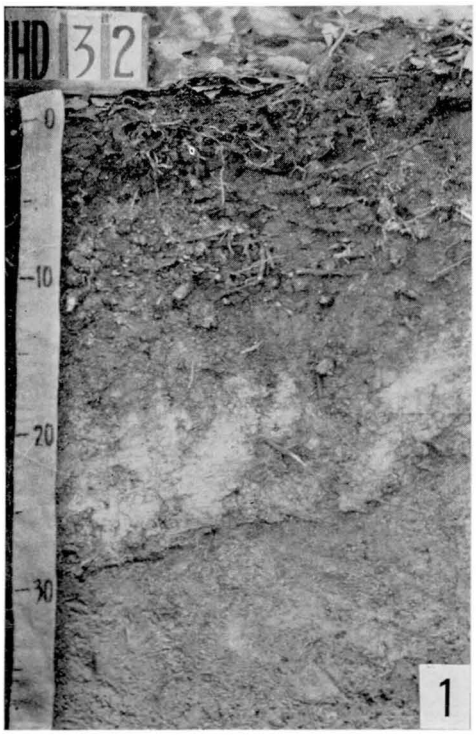
Plate VI

Fig. 1. A profile of the $P_{w(i)}I$ soil type in Shakadake national forest, Ishikawa Prefecture. This type forms well-developed gley horizon and iron pan. (1370 m alt.; 24. VII. 1974)

Fig. 2. A profile of the $P_{D}III$ soil type at Chûgû-lane, Ishikawa Prefecture. (1300 m alt.; 5. X. 1973)

Fig. 3. A profile of the B_{D} soil type (deluvial) in Ohshirakawa national forest, Gifu Prefecture. It has well-developed A horizon which is subdivided into two horizons. (1100 m alt.; 28. IX. 1974)

Fig. 4. A profile of $B_{D(d)}$ soil subtype (residual) in Shakadake national forest, Ishikawa Prefecture. H horizon develops weakly in this subtype. (1250 m alt.; 2. VI. 1975)


HD 32
0
10
20
30
1

HB 59
10
20
30
2

20
30
40
3

HD 2
20
30
4

Table 2. Synthesis table of the vegetation units classified

A. Camellietosum, B. Aesculetosum, C. Pinetosum, D. Cryptomerietosum, E. Typical subassociation, F. Tripetaleietosum, G. Dryopteridetosum, H. Abietetosum

Table 2-A

Subassociation	A		B				C				D				E				F		G				H		
Variant	1	2	1	2			1		2		1			2	1		2		1	2	1	2			1		2
Subvariant					b	c	a	b	a	b	a	b	c		a	b	a	b				a	b	c	a	b	
Number of quadrats	7	9	5	5	6	5	7	4	6	6	6	13	29	5	8	14	12	32	18	16	5	2	14	19	4	4	4
Character species of Association																											
Fagus crenata	V5	V2-5	V3-5	V3-5	V2-5	V5	V2-5	44-5	V3-5	V2-4	V4-5	V4-5	V2-5	V	V5	V4-5	V2-5	V4-5	V3-5	V3-5	V3-5	25	V4-5	V4-5	34-5	43-5	43-5
Acer japonicum	V+-2	III+-3	IV+-2	IV+-2	V+-3	IV1-2	II+-1	3+	II+	IV+-1	V+-3	V+-3	IV+-3	II1	V+-3	V+-3	V+-4	V+-3	IV+-3	V+-3	IV+-3	1+	V+-2	V+-2	3+-2	4+-2	41-2
A. sieboldianum	III+-2	II1-3	.	II+	I1	I+	V+-2	3+	V+-2	V+-2	I2	III+-1	III+-2	.	IV+-2	II+-1	III+-1	III+-2	V+-2	IV+-2	.	1+	I+	I1	.	.	4+-2
A. micranthum	III+-1	II+-1	I+	I+	II+	I1	III+-1	22	IV+	I+	V+-2	IV+-4	IV+-4	II+-2	II+-2	II+-3	II+-1	III+-2	IV+-2	IV+-3	.	11	I+	III+-2	.	.	.
Magnolia salicifolia	III+	IV+-1	I1	I+	.	.	V+-2	4+-1	V+-2	V+-3	V+-1	V+-2	V+-3	V+-3	IV+-2	V+-2	V+-2	III+-1	IV+-2	V+-2	IV+-2	2+-1	IV+-2	II+-2	.	31-3	41-2
Skimmia japonica forma *repens*	III+	I1	.	.	.	I+	IV+-2	3+	III+-1	I+	V+-1	IV+-2	V+-2	IV+-1	V+-2	V+-2	III+-2	III+-2	III+-2	IV+-2	III+-1	2+-1	IV+-2	II+-1	2+	2+-1	4+-1
Daphniphyllum macropodum var. *humile*	III+-1	II+-2	.	.	.	I+	IV+-2	21-2	II1	II+-1	I+	III+-2	III+-2	II+	V2-5	III+-3	IV+-3	IV+-3	III+-4	IV+-3	.	.	II1	II+-2	.	.	3+-2
Ilex leucoclada	V+	IV+-1	II+-1	II+	.	I+	.	.	.	.	V+-2	V+-2	V+-1	II+	V+-2	V+-2	V+-1	IV+-2	III+-2	V+-2	V+-1	21	V+-2	IV+-2	31	3+-1	4+-2
Carex morrowii var. *temnolepis*	II+-1	I+	.	I1	III1-5	VI-3	.	13	I+	.	V+-2	III+-2	II+-3	I1	I4	IV+-1	IV+-4	V+-5	III+-4	IV+-3	IV1-3	.	II1-3	II+-4	31-2	32-3	.
Goodyera maximowicziana	III+	I+	I+	.	.	.	.	.	I+	II+	I+	I+	I+	.	II+	I1	II+	I+	.	I+	II+-1	.	.	II+-1	.	.	1+
Smilacina japonica	III+	.	IV+-1	II+	II+-1	III+	.	.	.	.	III+	IV+-1	I+-1	III+	II+-1	III+-1	III+-1	III+-1	I+	II+-1	.	1+	IV+-2	IV+-1	.	.	3+
Paris tetraphylla	V+	I+	III+	.	II+-1	I+	I+	.	.	.	III+	IV+-1	II+-1	I+	IV+	V+-1	V+-1	I+	I+	III+-1	I+	2+	II+	II+	.	4+	4+-1
Dolichomitriopsis diversiformis	V+-1	V+-1	III+-1	V+	V+-1	V+	IV+	4+-1	V+	V+	V+-2	V+-1	V+-1	IV+-1	V+	V+-1	V+-1	V+-1	V+	V+	.	2+-1	III+	V+-1	2+	1+	4+-1
Hylocomiopsis ovicarpa	III+	II+	IV+	IV+	V+-1	V+	III+	2+	.	.	V+-1	IV+	III+-1	.	V+-1	V+-1	V+-1	III+-1	III+-1	III+-1	IV+-1	2+	V+-2	V+-1	2+	4+-1	4+-1
Brachythecium coreanum	II+	I+	IV+-1	III+	IV+-1	I+	I+	2+-1	.	.	II+	IV+	I+-1	I+	III+	II+	II+	II+	III+	II+	II+	1+	IV+	IV+-1	2+	2+	3+-1
B. rhynchostegielloides	III+	III+	.	I+	I+	I+	IV+	2+	.	.	II+	IV+	III+	III+	IV+-1	IV+	V+	II+-1	IV+	II+	V+-1	1+	IV+	III+	.	1+	3+
B. brotheri	V+-1	IV+	IV+-1	III+-1	V+-1	I+	.	.	.	.	I+	III+-1	II+	.	II+	II+-1	II+	II+-1	II+	I+	II+	1+	III+	V+-1	1+	2+	.
Hypnum fujiyamae	.	I+	.	II+	.	.	I+	.	II+-1	.	III+	I+	III+-1	II+	II+-1	I+	.	II+-1	II+	I+	.	.	I+	I+	.	.	.
Differential species of Subassociation																											
Camellia rusticana	V3-5	V1-5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aesculus turbinata	.	.	IV+-3	V3-4	IV2-3	II+-2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hydrangea macrophylla var. *megacarpa*	.	.	VI-3	II+-2	V+-1	IV+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	I+	.	.	.
Ligustrum tschonoskii	.	.	II+	IV+-2	V+-2	IV+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.
Dryopteris crassirhizoma	.	.	V+-2	VI-3	V+-3	IV+-4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
D. monticola	.	.	III1-2	I+	V+-3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polystichum tripteron	.	.	IV+-1	V+-2	I+	I1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P. retroso-paleaceum	.	.	II+	II+-1	I+	II+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.
Pinus parviflora	.	.	.	.	.	.	V+-3	31	V+-4	V2-4	.	.	.	I1	.	.	.	.	.	.	.	.	.	.	.	.	.
Thuja standishii	.	.	.	.	.	.	II+	12	III+-2	I1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gaultheria adenothrix	.	.	.	.	.	.	II+-2	2+-2	II+	I2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Epigaea asiatica	.	.	.	.	.	.	V+-4	1+	V+-2	V+-2	I+	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.
Brotherella henonii	.	.	.	.	.	.	II+	2+	IV+-1	V+	.	I+	I+	.	.	.	.	r+	II+	.	.	.	I+	.	.	1+	.
Cryptomeria japonica	.	.	.	.	.	.	.	.	.	.	V+-3	V+-3	V+-4	V2-4	.	.	.	.	.	.	.	.	.	.	.	.	.
Viburnum urceolatum var. *procumbens*	.	.	.	.	.	.	.	1+	.	.	II+-1	III+-2	III+-1	II+-1	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypnum tristo-viride	.	.	.	I+	.	I+	I+	.	V+	.	I+	II+	III+-1	V+	I+	I+	.	.	.	I+	.	.	.	.	.	.	.
Dryopteris austriaca	I2	.	V2-4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V+-3	22	V+-4	V+-4	1+	.	.
Smilacina yesoensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	I+	II+	1+	II+-1	IV+-1	1+	.	.
Abies mariesii	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	3+-2	4+-2	41
Cornus canadensis	.	.	.	.	.	.	.	.	.	.	V2-3	.	.	.	.	.	.	.	.	.	.	.	.	.	32-3	2+-1	3+-1
Coptis trifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1+	.	3+-1
Differential species of Variant and Subvariant																											
Oxalis griffithii	.	.	III+-2	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	r+	.	.	.	.	II+-1	II+-1	2+-1	.	2+
Plectranthus kameba var. *hakusanensis*	.	.	IV+-1	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pterocarya rhoifolia	I1	.	IV1-2	V+-2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumohra standishii	.	.	III+-1	IV+-3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euonymus melananthus	.	.	.	I+	IV+	IV+	.	.	I+	.	.	.	.	.	.	.	.	I+-1	.	.	.	.	.	.	.	.	.
Viola vaginata	.	.	.	I+	II+-1	III+-1	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	I+	I+	.	.	.
Cornus kousa	.	I+	.	.	.	V+	.	.	I+	.	.	.	.	.	.	.	.	III+-2	I+	I+	.	.	.	.	.	.	.
Acanthopanax sciadophylloides	I1	IV+-1	II+-1	.	I+	IV+-1	IV+-1	4+	.	I+	V+-1	V+-2	V+-2	III1	V+-2	IV+-3	V+-2	III+-2	III+-1	V+-2	IV+	21-2	V+-3	V+-2	3+	4+-1	4+-1
Rhododendron brachycarpum	.	.	.	.	.	.	.	.	II+-1	1+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chamaecyparis obtusa	.	.	.	.	.	.	.	.	V2-3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ilex pedunculosa	.	.	.	.	.	.	.	.	II1	III+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lyonia ovalifolia var. *elliptica*	.	.	.	.	.	.	.	.	V+-2	IV+-2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sorbus gracilis	.	.	.	.	.	.	.	.	V+-1	V+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Coptis japonica	.	.	.	.	.	.	.	.	.	.	.	.	III+-1	I+	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhododendron metternichii var. *hondoense*	.	.	.	.	.	.	.	.	.	.	.	.	.	V3-5	.	.	.	.	.	.	.	.	.	.	.	2+-1	.
Ainsliaea acerifolia var. *subapoda*	.	.	I+	.	.	I3	.	.	.	.	I+	II+-1	I+	.	.	.	III+-1	II+-3	I+	I+-1	.	2+-1	II+-1	III1-2	.	.	.
Pertya rigidula	.	I+-1	.	.	I+	I+	.	.	.	.	.	II+-2	I+	.	.	.	IV+	I+-1	I+	I+	.	.	I+	I+	.	.	.
Kalopanax pictus	.	.	.	I+	.	II+	.	.	.	I+	.	I+	I+	.	I+	I+	.	III+-2	II+	I+	.	1+	I+	II+-2	.	.	1+
Euonymus sieboldiana	.	.	I+	I+	.	I+	.	.	.	.	I+	.	.	.	.	.	.	II+-1	.	.	.	.	.	.	.	.	.
Osmunda asiatica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	23-4	.	.	.	.	3+-3
Athyrium yokoscense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	21-2	.	.	.	.	2+
Vaccinium hirtum	.	.	.	.	.	.	I+	.	.	.	I+	.	II+-2	.	.	.	.	.	I+	.	.	.	I+	.	3+	1+	.
Lycopodium obscurum	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	I+	II+-1	I+	.	.	.	I1	.	.	.	.	.	3+-1
Transgressive species to the subalpine birch-fir forest																											
Viburnum furcatum	V2-4	IV1-3	VI-4	IV+-3	V+-4	III+-3	V+-3	42-3	IV+-1	III1	V+-3	V2-3	V+-3	IV1-3	V2-4	V2-5	V2-4	V+-4	V+-3	V1-4	V2-4	2+	V3-4	V2-5	33-4	41-3	43
Sasa kurilensis	VI-3	IV1-5	IV1-3	III2-3	V+-2	I5	IV+	4+-4	.	.	V2-5	V+-3	V+-5	IV1-3	V3-4	IV+-5	IV+-4	IV+-5	III+-3	V+-2	V3-5	2+	V1-5	V+-5	35	43-5	43
Sorbus commixta	III+-1	III+-1	I+	.	III+	.	V+-1	1+	I1	I+	V+-1	III+	III+-1	II1	II+	V+-2	III+-2	I+-1	II+-2	III+-1	V1-3	21	III+-1	IV+	3+	41-2	3+-2
Menziesia pentandra	.	.	.	.	.	.	I+	2+-2	.	.	III1	II+-1	II+-1	I1	.	II2-3	.	.	I+	I+-2	.	22	.	.	.	4+-1	1+
Rhododendron albrechtii	.	.	.	.	II+	.	IV+-2	4+-2	I+	.	II+	.	IV+-2	I+	.	IV+-2	IV+-2	I+	IV+-1	IV+-1	.	.	I+	I+	1+	21-1	1+
Acer tschonoskii	.	.	II+	.	.	.	.	12	.	.	V+-3	II+-1	II+-3	IV+-3	II+-2	III+-2	I+-2	I+	I+	I+-1	III+-1	.	III+-1	I+	3+-1	41-2	3+-2
Plagiogyria matsumureana	V+-1	III+-2	III+-1	.	I+	.	.	4+-3	I2	.	V+-3	V+-3	V+-4	V+-2	III+-3	III+-2	IV+-3	III+-2	III+-2	III+-3	III+-2	21-2	III+-1	IV1-3	3+-1	32	3+-2
Rumohra mutica	III+-1	III+-1	.	.	I1	.	.	4+-1	I1	.	V+-2	V+-2	V+-2	III+-1	IV+-2	IV+-2	V+-2	III+-2	III+-2	IV+-2	IV+-1	21-1	III+-1	II+-1	2+-1	3+-1	41
Carex dolichostachya var. *glaberrima*	III+-1	I+	IV2-5	II5	.	.	.	.	.	.	II+	II+-1	.	.	II2	II+-3	II+-2	I1-2	.	.	V1-4	21-2	V+-3	V+-5	.	1+	.
Maianthemum dilatatum	I+	I+	.	.	.	.	.	.	.	.	II1-2	IV+-3	II+-1	I+	.	V+-3	II+-2	I+-1	.	III+-2	.	21	V+-3	III+-2	31	3+-1	4+-1
Clintonia udensis	.	.	.	.	.	.	.	.	.	.	I1	I+	.	.	.	III+-1	I+-1	.	.	.	I+	.	II+	I+	3+-2	4+-2	31
Streptopus streptopoides var. *japonicus*	I+	.	I+	.	.	.	.	.	.	.	II+	I+	I+	I+	.	.	.	.	.	I+	.	1+	II+-1	.	3+-1	3+-1	1+
Lycopodium serratum var. *serratum*	IV+-1	.	.	.	.	.	.	12	.	.	I+	II+-2	II+-2	II+	.	II+-1	I+-1	I+	I+	II+	II+-1	21	I+-1	I1	1+	21	2+
Dicranum viride var. *hakkodense*	V+-1	V+-1	V+	III+	V+	IV+	V+	3+	IV+	V+	V+	V+-1	V+-1	IV+	V+	IV+-1	V+-1	IV+-1	IV+-1	IV+-1	III+	2+	IV+-1	V+-1	2+	4+-1	4+-1
D. scoparium	.	.	.	I1	.	.	III+-1	1+	V+	IV+	IV+	I+	III+	I+	II+	I+	.	I+	I+	I+	.	.	.	I+	.	4+	.
Dolichomitriopsis crenulata	.	.	IV+	I+	I+	.	I+	1+	.	I+	III+-1	II+-1	III+-1	II+-1	II+-2	II+	III+	r+	.	III+	V+-1	.	IV+-1	III+-1	3+-1	4+	3+
Hylocomium pyrenaicum	.	.	III+	II+	III+-1	I+	.	1+	.	.	.	I+	I+	.	II+-1	I+	I+	II+	I+	I+	I+	.	I+	III+-1	.	1+	.
Hypnum pallescens	I+	.	.	.	.	.	III+	1+	.	.	II+	II+	II+	.	I+	II+	I+	.	I+	I+	I+	2+	I+	I+	2+	2+	1+
Rigodiadelphus robustus	.	.	.	.	.	.	II+	2+	.	.	.	I+	I+	.	III+	II+-1	II+-1	I+	I+	.	IV+	1+	III+	I+	1+	3+	4+
Callicladium haldanianum	.	.	I+	II+	.	I+	.	.	.	.	.	I+	I+	.	II+	II+	.	I+-1	.	I+	I+	.	I+	I+	.	.	.
Trachycystis flagellaris	.	.	.	.	.	.	.	1+	I+	.	.	.	I+	.	.	.	I+	I+	I+	I+	I+	.	I+	II+	.	1+	.
Transgressive species from the submontane oak forest																											
Quercus mongolica var. *grosseserrata*	I3	IV+-4	.	III2-3	IV+-3	II+-2	IV+-3	.	III+	IV1-3	.	I2	I+-3	II+-2	.	.	.	II+-4	III+-5	I+-2	I1	.	.	.	.	1+	.
Sorbus alnifolia	III1	II+-1	.	.	II+	II+	V+-1	1+	II+	V+-2	.	II+	I+	.	III+	I1	III+-1	II+-1	III+-2	III+-1	.	.	I+-2	I+-1	.	.	3+-2
Hamamelis japonica var. *obtusata*	III1-2	IV+-3	.	.	.	III+-2	V3-4	4+-3	VI-3	VI-3	VI	IV+-2	V+-3	II1	II+-3	IV+-3	V+-3	IV+-3	VI-4	V+-4	.	2+-2	II+-2	II+-1	2+-2	3+-2	4+-2
Clethra barbinervis	V+-2	IV+-3	.	I+	IV+-1	II1	V+-3	4+-3	V+-3	V+-3	V+-2	V+-2	V+-3	VI-3	III+-1	III+-3	V+-2	III+-2	V+-4	V+-2	.	21	II+-3	II+-2	1+	12	2+-2
Fraxinus lanuginosa	IV+-1	III+-1	II+-1	IV+-1	.	.	.	1+	III+-1	IV+-1	.	.	.	I+	.	.	II+-1	IV+-2	II+	II+	.	.	I+	II+	.	1+	.
Prunus grayana	I+	II+	III+-1	IV+	II+-1	I+	.	1+	.	II+	V+-1	V+-1	II+-1	I+	V+-2	V+-1	V+-1	V+-2	II+-1	III+-2	.	2+-1	V+-3	IV+-1	.	.	3+
Acer rufinerve	III+-1	III+-1	III1-2	IV+-1	III+	III+-1	.	.	.	I+	II+	II+	I+	.	IV+-1	IV+-2	III+-2	IV+-2	II+-1	II+-1	II+-1	21	V+-2	V+-2	.	.	.
Symplocos paniculata	III+	III+-1	IV+-2	I+	.	.	II+-1	.	I+	.	.	II+	I+	.	I+	II+	III+	III+-2	I+	II+	.	1+	I+	II+-2	.	.	.
Lindera umbellata var. *membranacea*	V+-1	V+-1	IV+-1	IV+-2	V+-1	V+-2	III+	4+-1	III+	III+-1	IV+-1	IV+-1	V+-1	II+	V+-1	III+-1	IV+-2	V+-3	V+-2	V+-2	.	21-2	V+-1	V+-2	.	3+	3+-1
Rhus trichocarpa	III+	IV+-1	II+-1	I+	I+	II+	V+-1	4+-1	V+-1	V+-1	V+-2	V+-2	V+-3	IV+-1	V+-2	V+-2	V+-1	IV+-1	V+-1	V+-1	II+	21	IV+-2	III+-2	21	3+	4+-2
Aucuba japonica var. *borealis*	VI-2	III+-1	II+-1	I1	I+	I2	.	.	.	.	III+	II+-2	II+-2	.	II1	II+-1	I1	III+-2	I+-1	I+-1	.	.	.	III+-1	.	.	.
Vaccinium japonicum	I+	III+-1	.	.	I+	I+	V+-2	3+-2	VI-3	V2-4	V+-2	V+-2	V+-2	V+-2	V+-2	V+-2	VI-3	III+-2	V+-3	V+-2	I1	2+	II+-2	I+	1+	4+-1	4+-2
Ilex crenata var. *paludosa*	.	I+	.	II+	VI-4	III+	IV+	2+	I+	I+	V+-2	II+-1	IV+-1	II+	V+-2	IV+-2	III+-1	III+-3	III+-3	IV+-1	III+-2	11	II+-2	II+-1	1+	4+-2	31-3
Disporum smilacinum	II+-1	II+	II+-2	.	II+	.	II+	.	.	II+-1	II+	III+-2	I+	.	III+-1	IV+-2	IV+-3	IV+-2	.	V+-2	.	.	I+	II+-1	.	.	1+
Blechnum niponicum	II+-1	III+	.	.	.	V+-1	III+	3+-1	IV+-2	.	.	II+-1	III+-2	II+	.	.	IV+-2	V+-1	V+-2	V+-2	I+	.	I+	I+	.	.	.
Mitchella undulata	IV+-2	II+-1	.	.	.	.	III+-2	1+	V+-3	IV+-2	II2	III+-2	IV+-2	.	IV+-2	IV+-1	III+-2	IV+-2	III+-1	III+-1	I1	21	II+-1	II+-2	21-2	21	3+-1
Rhus ambigua	III+	.	VI+-2	V+-2	V+-1	I+	.	.	.	.	III+-1	IV+-2	II+-1	.	IV+-1	IV+-1	III+-2	IV+-2	.	III+-1	III+	2+-1	V+-2	V+-1	1+	3+	2+-1
Schizophragma hydrangeoides	IV+	IV+-1	IV+-1	IV+-1	V+-1	IV+	I3	.	I+	.	III+-1	III+	III+-2	.	III+-1	III+-1	IV+-2	IV+-1	II+	III+-1	IV+	21	V+-1	V+-2	.	1+	.
Moisture elements																											
Acer mono	II1-2	.	II1-2	V+-2	V+-3	V+-2	.	.	.	.	.	.	.	I+	.	.	III+-2	V+-2	I+	II+	.	.	II+-1	III+-3	.	.	.
A. palmatum var. *matsumurae*	III+-1	II1-2	I1	IV+-3	V+-4	III2-3	.	.	.	.	I1	I+	I+	.	I1	I2	.	III+-3	I+	II+-1	.	.	.	III+-1	.	.	.
Tilia japonica	II1-2	.	.	IV+-1	V+-1	III+-1	.	.	.	.	.	.	.	.	.	.	.	II+-3	I1	I+	I+	.	.	II+-2	.	.	.
Cephalotaxus harringtonia var. *nana*	V+-1	.	IV+-2	V3-4	V1-3	V+-3	.	.	I+	.	.	.	I+	.	.	.	II+-1	IV+-2	III+-1	I1	.	.	.	III+-2	.	.	.
Euonymus oxyphyllus	I+	.	.	V+-1	V+-1	V+-1	I+	1+	.	.	.	I+	.	.	.	.	.	II+-1	I+	I+	.	.	II+-1	II+	.	.	.
E. alatus forma *ciliatodentatus*	III+	.	I1	V+-1	V+-1	II+	.	.	.	.	.	.	.	.	.	.	III+	I+	I+	I+	I+	.	III+	II+	.	.	.
Dryopteris sabaei	V+-1	.	.	II+-1	II+	IV+-1	.	.	I+	.	.	.	.	.	.	.	III+-1	I+-1	I+	.	.	.	.	.	.	.	.
Athyrium otophorum	I+	.	III+	.	.	IV+	.	.	.	.	.	.	.	.	.	I+	.	I+	.	.	.	.	.	III+	.	.	.
Hydrangea petiolaris	.	.	III+	IV+-1	II+	III+-1	.	.	.	.	I+	.	I+	I+	.	.	III+	.	.	I+	.	.	.	III+	.	.	.
Thamnobryum alopecurum	III+-1	.	IV+	III+	IV+-1	IV+	.	.	.	I+	.	.	.	I+	.	I+	I+	.	.	.	I+	.	.	III+	.	1+	.
Dry elements																											
Rhododendron nudipes	.	.	.	.	.	.	V+-3	12	V+-1	V1-2	.	.	.	I+-4	.	.	.	.	IV+-4	IV+-2	.	.	.	.	.	.	.
R. kaempferi	.	.	.	.	.	.	III+-1	12	I+	III+-1	.	.	I+	I+	.	.	.	.	II+-2	II+	.	.	.	.	.	.	.
Leucobryum neilgherrense	.	I+	.	.	.	.	III+	4+	V+	V+	I+	I+	I+	.	.	I+	I+	I+	II+-1	II+	.	.	.	.	1+	.	.
Tripetaleia paniculata	.	I1	.	.	.	.	V+-4	3+-3	V2-4	V+-3	.	.	V+-5	II1-2	.	.	.	.	V+-4	IV+-3	.	.	.	.	12	.	.
Ilex sugerokii var. *brevipedunculata*	.	.	.	.	.	.	VI-3	3+-3	VI-2	IV+-2	V+	.	II+-2	III1-2	I+	II+	I+	.	I+-2	III+-2	.	.	.	.	.	.	4+-1
Menziesia multiflora	.	I+	.	.	.	.	III+-1	3+	III+-1	II+	.	.	III+-2	II+-1	.	I1	II+-2	I+	III+-2	IV+-2	.	.	I2	.	.	.	.
Shortia uniflora	II3-4	III1-4	.	.	.	.	.	34-5	II5	II3-4	V3-5	IV3-5	III1-5	V3-5	.	.	.	.	IV1-5	II3-5	.	.	.	.	.	.	14
Heloniopsis orientalis	.	I+	.	.	.	.	II+	2+	I+	.	II+	.	III+-1	II+-1	I+	.	.	.	I+-1	I+	.	.	.	.	.	1+	.

Table 2-B

	A-1	A-2	B-1	B-2 a	B-2 b	B-2 c	C-1 a	C-1 b	C-2 a	C-2 b	D-1 a	D-1 b	D-1 c	D-2	E-1 a	E-1 b	E-2 a	E-2 b	F-1	F-2	G-1	G-2 a	G-2 b	G-2 c	H-1 a	H-1 b	H-2
Companions																											
Fauriella tenuis	V+-1	V+-1	V+-1	V+-1	V+	V+	V+	4+	V+-1	V+	V+-1	V+	V+-1	V+-1	V+	V+-1	V+	V+-1	V+	V+	III+-1	2+	V+	V+	1+	4+	4+-1
Thuidium kanedae	V+-1	V+-1	II+	V+-1	V+-1	V+	V+	2+-1	V+	V+-1	II+	III+	II+-1	I+	III+-1	III+	V+-1	V+-1	V+-1	V+-1	.	.	II+	V+-1	.	1+	1+
Hydrangea paniculata	.	.	I+	.	I+	I+	.	1+	.	.	V+-2	V+-2	V+-1	II+	III+-2	II+-1	I+	II+-1	II+-1	II+	I+	1+	II+-1	III+-2	2+	3+	4+
Brachythecium populeum	II+	I+	V+	V+	V+	V+	.	1+	.	.	.	.	.	.	II+	II+	I+	II+	I+	I+	I+	.	II+	II+	1+	.	1+
Fissidens cristatus	III+	II+	II+	III+	V+	V+	I+	.	.	.	I+	II+	I+	I+	I+	I+	I+	I+	.	II+	.	.	II+	II+	.	.	.
Corylus sieboldiana	II+	.	III+-3	III+	III+-1	V+	.	.	.	.	I+	.	.	.	I+	I+	I+	II+	I+	II+	III+-1	.	II+-1	III+-1	.	1+	.
Anomodon rugelii var. *rugelii*	.	I+	.	II+	I+	.	.	1+	.	.	I+	.	I+	.	I+	II+	I+	I+	II+-1	I+	I+	.	III+	II+-1	1+	.	.
Plagiothecium euryphyllum	.	.	.	I+	I+	I+	.	.	.	I+	.	I+	I+-1	.	I+	II+	.	I+	I+	I+	.	.	I+	II+	.	.	.
Dicranum nipponense	.	.	.	I+	III+	.	.	3+	.	I+	.	I+	I+	.	II+	I+	I+	II+	I+	II+	.	.	.	I+	.	.	.
Tripterospermum japonicum	.	.	.	.	.	.	.	1+	.	.	.	II+	II+	.	.	III+	II+	I+	I+	II+	I+	.	II+	II+	1+	2+	.
Cornus controversa	I2	.	III+-2	II+	II1	II+	.	.	.	.	.	.	.	.	.	I+	I+	I+-1	.	I+	II1	.	III+-2	V+-3	.	.	.
Thuidium bipinnatulum	II+	I+	.	.	I+	I+	.	.	.	.	.	I+	I+	.	.	.	.	.	I+	I+	I+	.	I+	II+	.	.	1+
Leucothoe grayana var. *oblongifolia*	.	.	.	.	.	.	V+-1	1+	III+	.	.	.	I+	.	I1	I+	III+-1	r+	II+-1	II+-1	.	1.	.	.	.	.	1+
Smilax nipponica	III+	I+	I+	.	.	.	.	.	.	.	III+	II+	I+	.	.	I+	II+	I+	.	I+	.	.	II+	III+	.	.	.
Magnolia obovata	V+-2	II+-1	II1-3	V+	.	.	.	.	.	.	.	II+-1	I+-1	.	II1-2	.	II+	II+-2	I+	.	.	.	.	II+-2	.	.	.
Rhynchostegium pallidifolium	.	I+	.	II+	I+	I+	.	.	.	.	.	.	I+	.	I+	I+	I+	II+	.	I+	.	.	.	.	.	.	.
Solidago virga-aurea var. *asiatica*	.	I+	.	.	.	.	.	1+	.	I+	.	.	.	.	.	I+	I+	I+	II+-1	II+-1	.	.	I+	.	1+	.	.
Monotropastrum globosum	.	V+-1	.	.	.	.	.	.	.	.	I+	I+	.	I+	.	.	I+	I+-1	.	I+	.	.	I+	I+	.	.	1+
Ardisia japonica	III+	II+-1	.	.	.	I+	.	.	.	.	I+	I+	II+-1	.	I+	.	.	.	I+	I1	.	.	I+	.	.	.	.
Athyrium squamigerum	I+	.	I+	II+	III+-1	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	I+	.	.	I+	II+-1	.	1+	.
Betula grossa	.	I2	.	II1-3	I2	.	.	.	II1-2	.	.	.	I+	.	.	.	.	r2	I1	I2	.	.	I2	.	.	.	.
Alnus hirsuta var. *sibirica*	.	.	.	I2	.	I2	I2	1+	I2	.	.	.	I+	.	.	.	.	I+	I2	I2	.	.	.	.	.	.	.
Rumohra miqueliana	.	.	.	.	II+	II+-1	.	.	.	.	.	.	.	.	I+	I+	I+	II+-1	.	I+-1	.	.	.	I1	.	.	.
Panax japonicus	.	.	I+	I+	II+	I+	.	.	.	.	.	.	.	.	.	.	I+	.	.	I1	II+	.	.	III+	.	.	.
Homalia japonica	.	.	.	.	.	II+	.	.	.	.	.	.	.	.	I+	.	I+	I+	I+	I+	.	.	I+	.	.	.	1+
Polygonatum lasianthum	I+	.	.	.	.	I+	.	.	.	I+	.	I+	.	.	.	.	.	I+	.	II+	.	.	I+	.	.	.	.
Pyrola japonica	.	I+	I+	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	I+	.	I+	.	.	I+	.	.	.	.
Vitis coignetiae	.	.	III+-1	I+	.	I+	.	.	.	.	.	.	I+	.	.	.	.	I+	.	I+	.	.	.	.	.	.	.
Rhytidiadelphus japonicus	.	.	.	.	.	.	.	1+	III+-1	.	.	.	.	.	.	I+	I+	I+	I+	.	.	.	.	.	.	.	.
Shortia soldanelloides	.	.	.	.	.	.	I3	12	I+	.	.	.	I+-1	.	.	.	.	.	.	I1	.	.	.	.	1+	.	.
Cacalia nikomontana	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	I1	r1	.	.	I+	.	II+-1	II+-1	.	.	.
Viburnum wrightii	.	.	.	I+	.	.	.	.	I+	II+-1	.	.	.	.	.	.	.	I+-1	I+-1	I+	.	.	.	.	.	.	.
Diphyscium fulvifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	I+	I+	I+	.	.	I+	.	.	.	.
Torreya nucifera var. *radicans*	.	.	.	.	I2	II+-1	.	.	.	I+	.	.	.	.	.	.	.	I+-1	I+	.	.	.	.	.	.	.	.
Plagiothecium nemorale	.	I+	.	I+	I+	.	.	.	.	.	.	.	.	.	.	.	.	r+	I+	.	.	.	.	.	.	.	.
Clinopodium gracile var. *multicaule*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	I+	.	.	.	III+	.	II+	I+	.	.	.
Actinidia arguta	.	.	.	III+	I+	.	.	.	.	.	I+	.	.	.	.	I+	.	.	.	.	.	.	I+	.	.	.	.
Celastrus orbiculatus	.	.	I+	II+	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	I+	I+	.	.	.	.	.	.	.
Peracarpa carnosa var. *circaeoides*	II+	.	II+-1	I+	III+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II+	.	.	.
Rodgersia podophylla	.	.	III+	I1	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	I+-1	.	.	.
Ctenidium pulchellum	.	.	I+	.	.	I+	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	I+	.	.	.
Hypnum oldhamii	.	.	.	.	.	.	.	.	II+	I+	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	1+	.
Acer distylum	.	.	.	.	.	.	.	.	II+-1	I1	.	.	.	.	.	.	.	.	I+-2	I+-1	.	.	.	.	.	.	.
Ribes ambiguum	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	I+	.	.	.	I+	.	.	.	I+	.	.	.	.
Atrichum undulatum	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	I+	.	r+	.	.	.	.	.	I+	.	.	.
Thuidium glaucinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	I+	I+	.	.	.	.	I+	.	.	.	.
Betula ermanii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I3	I3	.	.	.	III2-3	.	I2	.	.	.	.
Oplopanax japonicus	.	.	II1	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	1+	1+	.
Polytrichum formosum	.	.	.	.	.	.	.	1+	.	.	.	.	I+	.	.	.	.	.	I+	I+	.	.	.	.	.	.	.
Disporum sessile	.	.	III+-1	.	II+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II+	I+	.	.	.
Athyrium wardii var. *majus*	.	.	.	II+	I+	I+	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.
Bryhnia novae-angliae	.	.	.	I+	I+	.	.	.	.	.	.	.	.	.	.	.	I+	r+	.	.	.	.	.	.	.	.	.
Cacalia adenostyloides	.	.	I+	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II+	I+	.	.	.
Stachyurus praecox	.	.	.	.	.	I+	.	.	I+	I+	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.
Evodiopanax innovans	.	.	.	.	.	.	I+	.	I+	II+-2	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.
Styrax obassia	.	.	.	I+	.	.	.	.	I+	I+	.	.	.	.	.	.	.	I+-1	.	.	.	.	.	.	.	.	.
Myuroclada maximowiczii	I+	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	I+	.	.	.
Anomodon rugelii var. *ferrugineus*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	I+	.	.	.	.	.	I+	.	.	.
A. giraldii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	I+	.	.	.	.	.	I+	.	.	.
Brachythecium plumosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	r+	.	.	.	.	.	.	I+	.	.	.
Dicranodontium denudatum	.	.	.	.	.	.	.	.	.	.	.	I+	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	1+
Pleopeltis ussuriensis var. *distans*	.	.	.	.	.	.	.	.	.	.	I+	.	I+	.	I+	.	.	.	.	.	.	.	.	.	.	.	.
Brachythecium buchananii	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	I+	.	.	I+	.	.	.	.	.	.	.	.	.
Mnium laevinerve	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	I+	.	r+	.	.	.	.	.	.	.	.	.
Asperula odorata	.	.	.	.	I+	I+	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ulmus laciniata	.	.	.	III+-1	I+	I1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Helwingia japonica	.	.	.	.	I+	II+-1	.	.	.	.	.	.	.	.	.	.	.	r+	.	.	.	.	.	.	.	.	.
Trillium smallii	.	.	.	.	II+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	I+	.	.	.
Rumohra maximowiczii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	.	.	.	.	.	I+	.	.	.
Stewartia pseudo-camellia	.	.	.	.	.	.	.	.	.	.	.	II+-2	I1-2	I2	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex foliosissima	.	.	.	III-3	I1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hydrangea hirta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	I1	.	.	.	.	.	.	.	.
Wisteria floribunda	.	.	.	.	.	.	.	.	.	II+-1	.	.	.	.	.	.	.	r+	.	.	.	.	.	.	.	.	.
Dioscorea tokoro	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	.	.	.	.	.	.	.	.	.
Drepanocladus uncinatus	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1+	1+	.
Haplocladium angustifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	I+	.	.	.
Sambucus sieboldiana	.	.	.	.	.	II+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.
Alangium platanifolium var. *trilobum*	.	.	.	III+-1	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Brachythecium kuroishicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	I+	.	.	.
Hypnum callichroum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	.	.	.	.	I+	.	.	.	.
Dicranum flagellare	.	.	.	I+	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Enkianthus campanulatus	.	.	.	.	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1+	.
Ditrichum pallidum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	I+	.	.	.	.	.	.	.	.	.
Betula maximowicziana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I2	r2	.	.	.	.	.	.	.	.	.
Tsuga diversifolia	.	.	.	.	.	.	.	.	I+	.	.	.	.	I2	.	.	.	.	.	.	.	.	.	.	.	.	.
Lastrea totta	.	.	II+	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Actaea asiatica	.	.	.	.	I+	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Plagiomnium trichomanes	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.
Callicarpa japonica	.	.	.	I1	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.
Weigelia hortensis	.	.	I+	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gastrodia elata	.	.	I+	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.
Lastrea nipponica	.	.	II+	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carpinus laxiflora	.	.	.	.	.	.	.	.	II+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cymbidium goeringii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.
Prunus incisa var. *kinkiensis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	.	.	.	.	.	.	.	.	.
Phellodendron amurense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I1	.	.	.
Acer crataegifolium	.	.	.	.	.	.	.	.	.	II+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carpinus japonica	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pogonatum contortum	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
P. japonicum	.	.	.	.	.	.	.	1+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Laportea bulbifera	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ainsliaea apiculata	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polygonatum odoratum var. *pluriflorum*	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Asarum takaoi	II+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euonymus fortunei var. *radicans*	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Platanthera florentii	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pleopeltis annuifrons	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.
Hylocomium brevirostre var. *cavifolium*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.
Vaccinium oldhamii	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sorbus japonica	.	.	.	.	.	.	.	.	.	I1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Taxus cuspidata	.	.	.	.	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhizomnium nudum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.
Lycopodium clavatum var. *nipponicum*	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cercidiphyllum japonicum	.	.	.	I2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fissidens japonicus	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhbus hakonensis	.	.	.	II1-2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polygonum debile	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.
Meliosma tenuis	.	.	.	I1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Clematis japonica forma *purpureo-fusca*	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chloranthus japonicus	.	.	.	I1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Philadelphus satsumi	.	.	.	.	.	II+-2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Matteuccia struthiopteris	.	.	.	.	I2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Astilbe thunbergii var. *congesta*	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pleurozium schreberi	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypnum erectiusculum	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
H. fauriei	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Blechnum castaneum	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 6. Cryptomerietosum

1. *Mitchella undulata* variant: a. *Cornus canadensis* subvariant, b. Typical subvariant, c. *Tripetaleia paniculata* subvariant;
2. *Rhododendron metternichii* var. *hondoense* variant

| Variant | 1 | | |

Table 7. Typical subassociation

1. Typical variant: a. Typical subvariant, b. *Maianthemum dilatatum* subvariant; 2. *Acer mono* variant: a. Typical subvariant, b. *Acer palmatum* var. *matsumurae* subvariant

| Variant | 1 | | |

Table 14. Soil indicator value of beech forest plants on Mt. Hakusan

Table 14-A

Soil group	P				B										P		
Soil subgroup	Pw(h)	Pw(i)			gB	B									Po		
Soil type	III	I	II	III	gBo	BF	BE	BD				BB		BA	I		III
Soil subtype										BDcb							
Mode of deposition	r	r	r	r	r	c	c	d	r	r	d	r	d	r	r	r	r
Number of stands	5	6	7	6	12	2	12	13	11	19	19	28	3	5	9	5	7
Character species of Association																	
Fagus crenata	V3-5	V4-5	V3-5	V3-5	V4-5	2+-5	V3-5	V3-5	V4-5	V3-5	V3-5	V2-5	3 5	V2-5	V2-5	V5	V3-5
Acer japonicum	V+-5	V+-2	V+-3	III+-1	V+-2	1 2	V+-3	V+-2	V+-3	V+-3	V+-3	V+-3	.	V+-1	II+-1	V+-2	V+-;
A. sieboldianum	.	II1-2	III+-2	III+-2	.	.	I+-1	III+-2	II+-1	III+-2	III+-1	V+-2	2+-1	V+-2	III+-3	V+-2	V+
A. micranthum	.	III+-1	V1-2	V+-2	I1	.	II+-1	III+	V+-3	II+-2	III+-3	III+-3	1 1	II+	II+-2	V+-3	V+-
Magnolia salicifolia	II1-3	V+-1	V+-2	V+-2	V+-2	1 1	.	II+-1	V+-2	V+-2	V+-1	V+-3	2 1	V+-2	V+-3	V+-1	V+-
Skimmia japonica forma *repens*	III+-1	V+	V+-2	V+-2	III+-2	.	.	III+-1	V+-2	V+-1	III+-1	V+-2	2 1	I+	V+-1	III+-2	III+-
Daphniphyllum macropodum var. *humile*	.	.	III+-1	III1-2	II+	.	.	II+-3	III+-3	V+-5	II+-2	V+-2	2 1	I1	V+-2	II2-3	II+-
Ilex leucoclada	V+-1	V+-1	V+-2	V1-2	V+-2	1+	I+	III+-1	V+-2	V+-2	V+-2	V+-2	2+-1	.	I+	II+	V+-
Carex morrowii var. *temnolepis*	V2-3	III+	II+-2	.	III+-5	1 5	II1-3	V+-4	III+-3	II+-2	V+-3	III+-4	3+	I2	.	II+-4	II1-
Goodyera maximowicziana	.	.	I+	II+	I+	.	.	II+	II+-1	II+	II+-1	I+-1	1+	II+	.	.	.
Smilacina japonica	.	III+	III+	I+	V+-1	1 1	.	V+-1	V+-1	II+-1	II+-1	I+-1	2+-1	.	II+	I+	I+
Paris tetraphylla	III+	II+	III+-1	V+	III+-1	1+	I+	II+	III+	III+	II+-1	III+	.	.	I+	I+	I+
Dolichomitriopsis diversiformis	II+	V+-1	V+-2	V+-1	III+-1	2+	V+	V+-1	V+-1	V+-1	V+-1	V+-1	3+	V+	III+-1	V+	V+
Hylocomiopsis ovicarpa	V+-1	V+-1	V+-1	V+-1	V+-2	1+	V+	V+-1	V+-1	V+-1	III+-1	III+-1	1+	.	I+	II+-1	II+
Brachythecium coreanum	III+	II+-1	I+	III+	III+	1+	V+-1	II+	II+	III+-1	II+	II+	1+	I+	I+-1	III+	I+
B. rhynchostegielloides	I+	I+	V+	III+-1	V+	2+	I+	III+	V+	V+	III+-1	III+	.	.	II+	III+	V+
B. brotheri	II+	I+	.	V+	V+-1	2+-1	III+-1	V+	V+-1	III+-1	III+-1	II+-1	2+	.	.	II+	.
Hypnum fujiyamae	.	.	II+	I+	.	.	II+	.	II+-1	I+	II+-1	I+	.	.	I+	I+	I+
Differential species of Subassociation																	
Camellia rusticana	.	.	.	.	.	.	.	.	II4	II3-5	I3	II2-3	1 2	.	.	.	.
Aesculus turbinata	.	.	.	.	.	1 3	III+-4	II+-4	I2	.	.	.	.	.	.	.	.
Hydrangea macrophylla var. *megacarpa*	.	.	.	.	I+	2 1-3	V+-2	II+	.	.	I+	.	.	.	.	.	.
Ligustrum tschonoskii	.	.	.	.	I+	.	V+-2	II1-2	.	.	.	.	.	.	.	.	.
Dryopteris crassirhizoma	.	.	.	.	.	2+-2	V1-4	III1	.	.	.	.	.	.	.	.	.
D. monticola	.	.	.	.	I+	1 2	II+-3	.	I1	.	.	.	.	.	.	.	.
Polystichum tripteron	.	.	.	.	.	2+-1	III+-2	II+-1	.	.	.	.	.	.	.	.	.
P. retroso-paleaceum	.	.	.	.	.	1+	I1	I1	.	.	.	.	.	.	.	.	.
Pinus parviflora	.	.	.	.	.	.	.	.	.	I+-3	.	I1-2	.	V2-4	III1-3	II1-2	II1-;
Thuja standishii	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	I+-1	.	I+
Gaultheria adenothrix	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	I2	.
Epigaea asiatica	.	.	I+	.	.	.	.	.	.	I+	.	r+	.	V+-2	II+-2	II+-1	I2
Brotherella henonii	.	.	I+	.	.	.	.	.	.	I+	I+	I+	.	V+-1	II+-1	II+-1	I+
Cryptomeria japonica	.	V+-2	V1-3	II1-3	.	.	.	.	I2	I1-2	I4	I+-2	.	.	II2-4	.	.
Viburnum urceolatum var. *procumbens*	.	I1	III+-1	I1	.	.	.	.	.	I+-1	.	r+	.	.	I1	.	.
Hypnum tristo-viride	.	I+	II+	I+	.	.	I+	.	I+	I+	II+	r+	.	I+	II+	I+	I+
Dryopteris austriaca	I	I2	.	II+-2	V1-5	2 2-4	I4	II1-4	II+-4	I2-4	II1-4	r2	.	.	.	.	.
Smilacina yesoensis	.	.	.	.	II+-1	.	.	.	II+	r+	I+	r+	.	.	.	I+	I+
Abies mariesii	V+-2	I1	I1	.	.	.	.	.	I3	.	.	.	.	.	.	.	.
Cornus canadensis	III+-3	III2	III1-3	I1	.	.	.	.	.	.	.	.	.	.	.	.	.
Coptis trifolia	I+	.	I+	I+	.	.	.	.	I4	.	.	.	.	.	.	.	.
Differential species of Variant and Subvariant																	
Oxalis griffithii	I+	.	I+	I+	II+-1	1 1	I+-2	.	II+-1	.	I1	r+	.	.	.	.	.
Plectranthus kameba var. *hakusanensis*	.	.	.	.	.	1 1	I+	.	.	.	.	.	.	.	.	.	.
Pterocarya rhoifolia	.	.	.	.	I+	1 1	III1-2	I1	.	I1	.	.	.	.	.	.	.
Rumohra standishii	.	.	.	.	.	2 1-2	II+-3	I+	.	.	.	.	.	.	.	.	.
Euonymus melananthus	.	.	.	.	.	.	III+	I+	I+	.	.	.	1+	I+	.	.	.
Viola vaginata	.	.	.	.	I+	.	I+-1	.	.	.	I+	.	.	.	.	.	.
Cornus kousa	.	.	.	.	.	.	I+	II+	.	.	I+-2	.	.	.	.	.	.
Acanthopanax sciadophylloides	V+	V+-2	V+-2	V1-2	V+-2	1+	II+-1	V+-2	V+-3	V+-2	V+-2	V+-2	2 1	I+	II+-1	III+-2	V+
Rhododendron brachycarpum	II+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	II+-2	.	.
Chamaecyparis obtusa	.	.	.	.	.	.	.	.	.	.	.	.	.	III1-2	I2	I2	I3
Ilex pedunculosa	.	.	.	.	.	.	.	.	.	.	.	I+	.	III+-1	I+	.	I1
Lyonia ovalifolia var. *elliptica*	.	.	.	.	.	.	.	.	.	.	.	I+-1	.	III+-1	I+	I1	I2
Sorbus gracilis	.	.	.	.	.	.	.	.	.	.	.	I+-1	.	V+-1	I+-1	I1	.
Coptis japonica	.	.	.	I1	.	.	.	.	I+	r+	I1	.	.	.	I+	.	.
Rhododendron metternichii var. *hondoense*	I1	.	.	.	.	.	.	.	.	.	.	.	.	.	II3-5	.	.
Ainsliaea acerifolia var. *subapoda*	.	II+-1	I+	I+	III+-2	1+	.	II1	I+	I+-1	III+-2	I+-1	.	.	.	.	.
Pertya rigidula	.	.	I+	.	.	.	.	II+	I+-2	r+	I+	I+	1 1	.	.	.	.
Kalopanax pictus	.	.	.	I+	I+	.	I+	II+	I+	I+	I+	.	2+	I+	.	I+	II+
Euonymus sieboldiana	.	I4	I+	I2	.	.	I+	I+	.	.	.	.	.	.	.	.	.
Osmunda asiatica	.	I1	.	I2	.	.	.	.	.	.	.	.	.	.	.	.	.
Athyrium yokoscense	II+	.	.	I+	.	.	.	.	I+	r1	I+	I+	.	.	I+	I+	I+
Vaccinium hirtum	.	.	I1	II+	I+-1	.	.	.	.	r+	I1	I+	.	.	.	.	.
Lycopodium obscurum	.	.	I+	.	.	.	.	I+	.	.	I+-1	I+	.	.	.	.	.
Transgressive species to the subalpine birch-fir forest																	
Viburnum furcatum	V1-4	V1-4	V+-3	V3-4	V3-5	2 1-4	V+-4	V+-4	V2-4	V+-4	V1-4	V2-4	3 1-4	III1-2	III+-3	V+-2	V4-
Sasa kurilensis	V5	V+-5	V+-3	V+-3	V+-5	1 2	III+-3	V+-5	V+-5	V+-5	V+-5	V+-4	2+-3	.	II1-4	III+	V+-
Sorbus commixta	V+-2	V+-1	V+	V+-1	V+	.	I+	II+-1	V+	III+-1	III+-2	III+-2	1+	.	II+-1	I+-1	III+-
Menziesia pentandra	III+-1	III+-2	III+-1	I2	I2	.	.	.	.	I+-3	I+	II+-2	.	.	II+-2	.	II+
Rhododendron albrechtii	II+-1	III+	III+-2	I1	I1-2	.	I+	II+-1	I+-1	II+-1	II+-1	III+-2	.	II+-1	II+	III+-1	V+
Acer tschonoskii	V1-2	V+-3	III+-1	V+-1	III+-2	1+	I+	.	II+-1	I1-2	II+-1	II+-2	.	.	II2-3	I+	.
Plagiogyria matsumureana	V+-2	V1-3	V+-3	V+-3	III+-3	1 1	.	III+-3	V+-2	III+-3	V+-3	III+-2	2 2	.	III+-3	V+-2	V+-
Rumohra mutica	V+-1	V+-2	V1-2	V+1	III+-1	.	I1	III+-2	V+-2	III+-2	V+-2	V+-2	1+	.	II+-1	V+-1	V+
Carex dolichostachya var. *glaberrima*	I+	II+-2	II+-1	III1-2	V+-5	1 5	II5	II2-5	III+-4	I+-5	III1-4	I+-4	1 2	.	.	.	.
Maianthemum dilatatum	V1-3	V+-2	II+-2	V+-1	III+-2	.	II+	II+-2	V+-3	II+-3	I+	II+-3	1+	.	.	I+	II+-
Clintonia udensis	V+-2	I1	I1	I1	II+-1	.	.	II+	I+	I+	I+	I+	.	.	.	.	.
Streptopus streptopoides var. *japonicus*	V+-1	II+	I+	II+	I+	1 1	.	.	II+	r+	.	I+	.	.	I+	.	.
Lycopodium serratum var. *serratum*	I1	II+-1	I+	II+-1	I+	.	.	I+	II+	II+	I+	II+-1	1+	.	II+-1	.	I+
Dicranum viride var. *hakkodense*	V+	V+-2	V+-1	V+	V+	2+	V+	V+-1	V+	V+	V+-1	V+-1	3+	V+	V+	V+	II+
D. scoparium	III+	II+	V+	II+	I+	.	.	.	I+	I+	I+	I+	.	V+	III+-1	I+	I+
Dolichomitriopsis crenulata	V+	II1	III+	III+-2	II+-1	1+	II+	II+	II+-1	II+	I+	II+-1	1+	I+	II+-1	.	.
Hylocomium pyrenaicum	I+	.	.	.	II+	1+	III+-2	II+-1	I+	I+-1	I+	I+	2+	.	.	II+	.
Hypnum pallescens	III+	I+	I+	V+	I+	.	.	I+	II+	I+	II+	II+	.	.	I+	.	.
Rigodiadelphus robustus	V+	I+	I+	II+	II+	.	.	I+	II+	I+	I1-2	II+-1	.	.	I+	I+	.
Callicladium haldanianum	.	.	.	.	I+	.	I+	.	.	I+	II+	I+	.	.	.	.	.
Trachycystis flagellaris	I+	.	.	.	I+	.	.	II+	.	.	I+	.	.	I+	.	.	.
Transgressive species from the submontane oak forest																	
Quercus mongolica var. *grosseserrata*	I+	.	.	I+	.	.	II+-3	II+-2	I2	II+-3	I1	II+-3	.	V+-2	III1-2	II+-2	II+-
Sorbus alnifolia	.	.	II+-2	I1	I+	.	I+	II+	III+-1	III+-1	I+-1	III+-1	2+-1	V+-2	I1-2	III+	I+
Hamamelis japonica var. *obtusata*	V+-2	V+-2	V+-1	V+-2	III+-1	.	II+-2	V+-3	III+-3	V+-4	V1-3	V+-4	3+-1	V+-2	V+-1	V+-3	V1-
Clethra barbinervis	II+-2	V+-3	V+-2	V+-1	II+-2	.	II+-1	V+-2	V+-2	V+-3	V+-3	V+-2	2 1	V+-3	V1-2	V+-4	V+-
Fraxinus lanuginosa	I+	.	.	.	II+	.	V+-3	V+	II+-1	II+-1	I1	I+-2	1 1	V+	I+-1	I+	II+
Prunus grayana	.	V+-1	V+	V+-1	V+-1	1+	II+	V+-1	V+-1	III+-1	III+-1	III+-2	2+-1	II+	I+	II+-2	II+
Acer rufinerve	.	II+-1	II+	V+-1	V+-2	1 1	III+-2	III+-1	V+-1	II+-2	III+-2	III+-2	3+-1	II+-1	.	I+	.
Symplocos paniculata	.	.	.	II+	I+	.	.	II+-1	I+	II+	I+-2	III+	2+	.	.	II+	.
Lindera umbellata var. *membranacea*	III+	V+-2	V+-1	V+-1	V+-2	2+-1	V+-2	V+-2	V+-1	V+-2	V+-2	V+-2	3+-2	III+-1	III+-1	V+-1	V+-
Rhus trichocarpa	V+-1	V+-2	V+-2	V+-1	V+-2	1 1	I+	V+-2	V+-2	V+-1	V+-1	V+-2	1 1	V+-1	V+-1	V+	V+-
Aucuba japonica var. *borealis*	.	I+	III+-1	I1	I1	.	II+-2	III+-2	II+-1	III+-2	III+-2	II+-1	3 1	.	.	.	I1
Vaccinium japonicum	V+-2	V+-1	V+-2	V+-2	II+-1	.	I+	V+-2	V+-2	V+-3	V+-2	V+-2	1+	V+-4	V+-3	V+-2	V1-
Ilex crenata var. *paludosa*	V1-2	III+	III+-2	V+-1	II+-2	.	II+-4	III+	III+-1	III+-1	III+-2	V+-2	2+	I+	II+	III+-1	II+-
Disporum smilacinum	.	II+	II+-2	I1	II+-1	.	I+	III+-2	II+-1	II+-2	III+-2	III+-3	2+	II+-1	I+	I+	I+
Blechnum niponicum	.	I+	II+-2	I+	.	.	I+	V+-2	II+-1	II+	V+-2	III+-2	2+	I1	I+	V+-2	V+
Mitchella undulata	III1-2	III+	II1-2	V+-1	II+	.	.	II+-1	V+-2	III+-1	III+-1	V+-2	1+	V+-2	I1-2	II+-2	V+-
Rhus ambigua	.	II+-1	II+	V+-1	V+-2	1 1	III+-2	III+-1	V+-1	II+-2	III+-2	III+-2	3+-1	II+-1	.	I+	.
Schizophragma hydrangeoides	.	II+-1	V+	V+-1	V+-1	1 1	V+-1	V+-1	III+-1	III+-2	V+-2	II+-2	2 1	.	.	II+	II+

Table 14-B

	Pw(h) III	Pw(i) I	Pw(i) II	Pw(i) III	gBo	BF	BE	Bo				Bs		BA	Pb I	Pb II	Pb III
										Bo(d)							
	r	r	r	r	r	c	c	d	r	r	d	r	d	r	r	r	r
Moisture elements																	
Acer mono	.	.	.	.	III+3	1_1	IV+-3	IV+-1	I+	I+-2	III+-1	I+	2+-1	.	.	.	II+
A. palmatum var. *matsumurae*	.	.	I_1	.	I+-1	.	IV+-3	II+-2	II_{1-2}	II_{1-2}	II+-1	I+-3	1_1	.	.	.	.
Tilia japonica	.	.	.	.	I+	.	III+-1	II+-1	I+-2	I+-1	II+	r+	.	.	.	.	.
Cephalotaxus harringtonia var. *nana*	.	.	.	I_1	II_{1-2}	1_1	V+-4	IV+-4	II+	II+-2	III+-2	I+	2_1	I+	.	I+	.
Euonymus oxyphyllus	.	.	.	.	II+-1	.	III+-1	II+-1	I+	r+	II+	r_1	1+	.	I+	I+	.
Euonymus alatus forma *ciliatodentatus*	.	.	.	.	III+	.	III+-1	IV+-1	II+	II+	III+	r+	1+	I+	.	.	.
Dryopteris sabaei	.	.	.	.	.	.	III+-1	II+-1	I+	I+-1	I+-1	I+	2_1	.	.	I+	.
Athyrium otophorum	.	.	.	.	II+-1	1+	II+	II+	I+	I+	I+	r+	.	.	.	.	.
Hydrangea petiolaris	.	.	I+	.	II+-1	1+	III+-1	II+-1	.	I+	I+	r+	1+	.	.	.	.
Thamnobryum alopecurum	I	.	.	.	II+	1+	IV+-1	II+	I+	I+	I+	r+	1+	I+	.	.	.
Dry elements																	
Rhododendron nudipes	.	.	.	.	.	.	.	.	.	II+-3	II+-2	II+-4	.	V_{1-2}	II_1	III+-1	II+-1
R. kaempferi	.	.	.	I_1	.	.	.	I+	.	I+-1	II+-2	I+-2	.	III+-1	I+-1	.	II+-1
Leucobryum neilgherrense	.	.	I+	.	.	.	.	I+	.	I+	III+-1	I+-1	.	IV+	II+	II+	III+
Tripetaleia paniculata	I_2	.	I_3	I_1	.	.	.	.	I_2	II_{1-4}	II+-4	III+-3	.	V+-3	III_{1-3}	V_{1-4}	V+-3
Ilex sugerokii var. *brevipedunculata*	.	V+	III+-1	II_{1-2}	.	.	.	.	.	II+-3	I_{1-2}	II+-2	.	III+-2	V_{1-3}	I_2	II+-2
Menziesia multiflora	.	.	II_{1-2}	I_1	.	.	.	.	.	II+-1	II+-2	III+-2	.	.	IV+-1	IV+-2	IV+-2
Shortia uniflora	.	V_{3-4}	IV_{3-4}	II_{4-5}	.	.	.	.	I_3	II_{3-5}	I_5	II_{4-5}	1_2	II_{3-4}	III_{3-5}	IV_5	III_{3-4}
Heloniopsis orientalis	.	III+	.	.	.	.	.	.	I+	I+	II+-1	I+	1+	.	II+-1	II+-1	II+
Companions																	
Fauriella tenuis	IV+	V+-1	V+-1	V+	IV+-1	1+	V+	V+	V+-1	V+-1	V+	IV+-1	3_{+-1}	IV+-1	V+-1	V+	V+
Thuidium kanedae	I+	II+-1	I+	III+-1	III+-1	1+	V+-1	IV+-1	IV+	IV+-1	IV+	III+-1	2+-1	V+-1	II+	IV+	IV+
Hydrangea paniculata	IV+	V+-2	V+-1	V+-2	III+-2	.	I+	II+	II+	II+-1	II+	II+-1	1_1	.	I+	III+	II+
Brachythecium populeum	I+	IV+	.	III+	II+	1+	IV+	II+	II+	I+	II+	I+	1+	.	I+	II+	I+
Fissidens cristatus	.	I+	II+	.	III+	2+	III+	II+	I+	I+	II+	II+	.	.	I+	.	.
Corylus sieboldiana	I+	I+	.	.	II+	.	III+-3	III+-1	.	I+	III+-1	I+	.	.	.	.	.
Anomodon rugelii var. *rugelii*	I+	I+	.	.	III+	.	I+	II+	.	I+	II+	.	.	.	.	I_r	I+
Plagiothecium euryphyllum	.	.	.	I+	II+	.	I+	II+	.	I+	I+-1	r+	.	I+	.	.	.
Dicranum nipponense	.	.	.	.	I+	.	II+	II+	.	I+	I+	I+	.	I+	I+	I+	I+
Tripterospermum japonicum	III+	.	II+	I+	II+	.	.	I+	I+	.	II+	II+	.	.	.	I+	.
Cornus controversa	.	.	.	.	II+-2	.	III+-2	II+	I+	I_1	II+-1	I+	.	.	.	.	I+
Thuidium bipinnatulum	.	I+	.	I+	I+	r_r	I+	.	I+	I+	I+	.	.	.	.	.	I+
Leucothoe grayana var. *oblongifolia*	.	.	I+	I_1	.	.	.	.	.	II_1	I_1	II+-1	.	I+	II+-1	II+	I_1
Smilax nipponica	.	II+	I+	II+	II+	.	I+	II+	II+	II+	II+	r+	.	.	.	.	.
Magnolia obovata	.	.	I+	.	II+-3	2_{1-3}	II+	II+	II+-2	I_{1-2}	I+-2	I+-1	.	.	.	.	.
Rhynchostegium pallidifolium	.	.	.	.	I+	.	II+	II+	I+	.	.	I+	.	.	.	I+	.
Solidago virga-aurea var. *asiatica*	I+	.	.	.	.	.	.	I+	.	.	I+-1	I+	.	II+	.	I+	I+
Monotropastrum globosum	.	I+	II+	.	.	.	.	.	.	.	I+	I+-1	.	.	.	.	.
Ardisia japonica	.	I_1	II+	.	.	.	.	I+	.	r+	.	I+-1	.	.	.	.	.
Athyrium squamigerum	I+	.	.	.	.	.	II+-1	II+	I+	r+	I+	r+	2+	.	.	.	.
Betula grossa	.	.	I+	.	.	.	I_{1-2}	.	.	.	.	I+-2	.	I_1	.	I_2	.
Alnus hirsuta var. *sibirica*	.	.	.	.	.	.	I_2	.	I_1	.	I+	r_2	.	.	.	I_2	.
Rumohra miqueliana	.	.	.	.	.	.	I+	II+	I+	r+	I+	.	2+	.	.	I+	I+
Panax japonicus	.	.	.	.	II+	.	I+	II+	I+	.	I+	r+	.	.	.	.	.
Homalia japonica	.	.	.	.	.	.	I+	.	.	r+	.	.	.	.	.	I_r	.
Polygonatum lasianthum	.	.	I+	.	.	.	.	.	.	I+	I+	I+	.	I+	.	.	I+
Pyrola japonica	.	.	.	.	I+	1+	.	I+	I+	.	I+	r+	.	.	.	.	.
Vitis coignetiae	.	.	.	.	I+	1+	II+-1	.	.	.	.	.	.	.	.	.	I+
Rhytidiadelphus japonicus	.	.	.	.	I+	.	.	.	.	.	.	r+	.	I_1	.	II+	.
Shortia soldanelloides	I_2	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	I+
Cacalia nikomontana	.	.	.	.	I+-1	.	.	II+-1	I+	.	I+	.	1+	.	.	.	.
Viburnum wrightii	.	.	.	.	.	.	.	II+	.	r_1	I+	I+-1	.	III+-1	.	.	.
Diphyscium fulvifolium	.	.	.	.	.	.	.	II+	.	r+	I+	.	.	.	.	.	.
Torreya nucifera var. *radicans*	.	.	.	.	.	.	I+-2	.	.	.	.	.	1+	I+	.	.	.
Clinopodium gracile var. *multicaule*	.	.	.	.	I+	.	.	I+	.	I+	II+	.	.	.	.	.	.
Actinidia arguta	.	.	.	.	I+	.	II+	.	.	.	.	I+	.	.	.	.	.
Celastrus orbiculatus	.	.	.	.	.	.	I+	I+	.	.	.	.	.	.	.	.	.
Peracarpa carnosa var. *circaeoides*	.	.	.	.	I+	.	I+-1	I+	I+	I+	.	r+	.	.	.	.	.
Rodgersia podophylla	.	.	.	.	I+	.	I+-1	II+	.	.	I+	r+	.	.	.	.	.
Ctenidium pulchellum	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.
Hypnum oldhamii	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.
Acer distylum	.	.	.	.	.	.	.	.	.	.	.	I_1	.	.	.	III+-1	II+
Ribes ambiguum	.	.	.	.	.	.	.	.	I+	.	I+	.	.	.	.	.	.
Atrichum undulatum	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.
Betula ermanii	.	.	.	.	I_3	.	.	I_2	.	.	I_{2-3}	I_3	.	.	.	.	.
Oplopanax japonicus	I+	.	.	.	I+-1	1_1	.	.	.	.	.	.	.	.	.	.	.
Polytrichum formosum	.	.	.	.	.	.	.	I+	.	.	.	r+	.	.	.	.	.
Disporum sessile	.	.	.	.	I+	1_1	I_1	I+	.	.	I+	.	.	.	.	.	.
Athyrium wardii var. *majus*	.	.	.	.	.	.	II+	.	.	.	.	.	.	.	.	.	.
Bryhnia novae-angliae	.	.	.	.	I+	.	I+	.	.	.	II+-1	.	.	.	.	.	.
Cacalia adenostyloides	.	.	.	.	II+	1+	.	I+	.	.	I+	.	.	.	.	.	.
Stachyurus praecox	.	.	.	.	I	.	.	.	.	.	.	.	.	II+	I+	.	.
Evodiopanax innovans	.	.	.	.	.	.	.	.	.	r+	.	I+	.	II+-2	.	I+	.
Myuroclada maximowiczii	.	.	.	.	.	.	.	.	.	I+	.	.	1+	.	.	.	.
Brachythecium plumosum	.	.	.	.	.	1+	I+	.	.	.	.	.	.	.	.	.	.
Dicranodontium denudatum	.	.	I+	.	.	.	.	.	.	.	.	r+	.	.	.	.	.
Mnium laevinerve	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	I_r	.
Ulmus laciniata	.	.	.	.	.	.	I+	II+-1	.	.	.	.	.	.	.	.	.
Helwingia japonica	.	.	.	.	.	.	I+-1	.	.	.	.	.	.	.	.	.	.
Rumohra maximowiczii	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.
Stewartia pseudo-camellia	.	.	.	I+	.	.	.	.	.	r_1	.	r_2	.	.	I_2	.	.
Carex foliosissima	.	.	.	.	I+	.	I+	I+	I+	.	.	.	.	.	.	.	.
Hydrangea hirta	.	.	.	.	.	.	.	.	.	.	.	.	.	I_1	.	.	.
Wisteria floribunda	.	.	.	.	.	.	.	.	.	.	.	I+	.	II+-1	.	.	.
Dioscorea tokoro	.	.	.	.	.	.	I+	.	I_1	.	.	.	.	.	.	.	.
Drepanocladus uncinatus	II+	.	.	.	.	1+	.	.	.	.	.	.	.	.	.	.	.
Sambucus sieboldiana	.	.	.	.	I+	.	I+	I+	I+	.	.	.	.	.	.	.	.
Alangium platanifolium var. *trilobum*	.	.	.	.	.	.	III+-1	.	.	.	.	.	.	.	.	.	.
Brachythecium kuroishicum	.	.	.	I+	.	.	.	I+	.	.	.	.	.	.	.	.	.
Carpinus laxiflora	.	.	.	.	.	.	.	.	.	.	.	r_3	.	.	.	I+	.
Prunus incisa var. *kinkiensis*	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.
Phellodendron amurense	.	.	.	.	I_1	.	.	.	.	.	.	.	.	.	.	.	.
Acer crataegifolium	.	.	.	.	.	.	.	.	.	.	.	r_1	.	II+	.	.	.
Laportea bulbifera	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.
Asarum takaoi	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	.	.	.
Euonymus fortunei var. *radicans*	.	.	.	.	.	.	I+	II+	.	.	.	.	.	.	.	.	.
Lycopodium clavatum var. *nipponicum*	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rubus hakonensis	.	.	.	.	.	.	I_1	I_2	.	.	.	.	.	.	.	.	.