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A Phytosociological Study and a Tentative Draft on Vegetation Mapping of the Secondary Forests in Hiroshima Prefecture with Special Reference to Pine Forests[1,2]

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ABSTRACT Secondary forests of pine and deciduous broad-leaved trees developed in Hiroshima Prefecture, southwestern Japan, were studied phytosociologically, with special reference to pine forests. Pine forests, which cover about 70% of the forest area in the prefecture, were identified with the order *Pinetalia densiflorae* Suz.-Tok. 1966, and were classified into three alliances and ten associations accompanied by several subassociations. Deciduous broad-leaved secondary forests were divided into three vegetation units. The associations of the pine forests were defined in consideration of natural climax forests, and were discussed in relation to several factors, such as climatic, edaphic and topographic conditions, succession, fire, cutting, and other forest managements. Based on results of the study on the distributional range of vegetation units, a tentative draft was proposed for making vegetation maps of secondary forests in Hiroshima Prefecture. On the other hand, a detailed classification of pine forests developed in the coastal area was made, and vegetation units were discussed in relation to fire. It was suggested that the degradation or progression of the community in secondary succession is controlled by the intensity and frequency of fire.

KEY WORDS pine forest, secondary forest, classification, mapping method, degradation

INTRODUCTION

Forests of *Pinus densiflora* Sieb. et Zucc., which are most familiar to Japanese people, are very widely distributed, ranging through three climatic zones: the warm-, mixed- and cool-temperate zones. Some of them are natural, occurring as an edaphic climax forest on poor sites such as steep and rocky ridges, dry lands of highly weathered granitic rocks and marginal parts of moors, but they appear most commonly as an initial forest on bare or disturbed lands. Most of the pine forests are thus secondary forests or artificial plantations, which have been strongly influenced by human activities. The characteristics of the pine forests are diversified in relation to several factors: climatic, edaphic and topographic conditions; human activities such as fire, cutting, and forestry or agricultural management; and successional stages of forests.

Floristically, the pine forests resemble the deciduous or evergreen broad-leaved

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secondary forests. The deciduous broad-leaved secondary forests dominated by *Quercus serrata, Q. monoglica* var. *grosseserrata, Q. variabilis, Q. acutissima,* or *Castanea crenata,* and the evergreen braod-leaved secondary forests dominated by *Quercus (Cyclobalanopsis) glauca, Q. (C.) salicina, Q. (C.) myrsinaefolia, Q. phillyraeoides, Pasania glabra,* or *Castanopsis cuspidata* are developed on sites under conditions similar to those of the pine forests, and they are frequently mixed with pine trees. It is not easy to distinguish clearly the pine forests from other secondary forests by the physiognomy alone. The cause of difficulties or confusion in classification of the pine forests lies in this situation.

Mapping of the vegetation is one of the practical uses for phytosociology, and also, it means one of the ways to inspect the validity of the vegetation units classified within the phytosociological table. In 1975, actual vegetation maps of each prefectural area of Japan at a scale of 1: 200,000 were published under the sponsorship of Environment Agency. The vegetation units adopted for those maps were principally associations which were floristically defined. In those maps, the pine forests occupy a large area of southwestern Honshu; for example, in Hiroshima Prefecture, they cover about 70% of all the forest area. The pine forests in Hiroshima Prefecture were, at that time, represented by only two units: *Rhododendro-Pinetum azumanum* in the cool-temperate region and the *Rhododendro reticulati-Pinetum densiflorae* in the warm-temperate region. However, these legends for the pine forests are not considered to be sufficient for the practical use of the vegetation map. It means that a more detailed classification of the pine forests must be made and the more advanced method of vegetation mapping should be studied.

The present study deals with a classification of secondary forests in Hiroshima Prefecture, with special reference to pine forests, and suggests a method of vegetation mapping.

AREA STUDIED

Hiroshima Prefecture is situated on about 34°00′–35°19′N and 132°00′–133°30′E, lying to southward of the Chugoku mountains in southwestern Honshu, Japan. It is generally formed by low mountains having gentle slopes, and the highest elevation in this prefectural section is 1,346 m above sea-level. Three erosion surfaces with moderate slopes have usually been recognized in Hiroshima Prefecture, named respectively Dogoyama surface (about 1,000–1,350 m above sea-level), Kibi-plateau surface (about 500–600 m) and Setouchi surface (lower than about 300 m). Areas between these surfaces form steep slopes intersected by many gorges. A landform division of Hiroshima Prefecture (Naruse 1977) is shown in Fig. 1, and two cross sections of the Chugoku mountains in the N–S direction are shown in Figs. 2 and 3. The southern areas facing the Seto Inland Sea consist of lowlands, the intermediate areas are formed by the plateau, platform and intra-montane basin, and the northern areas forming the watershed of the Chugoku mountains consist of higher elevations. The three erosion surfaces are clearly seen in the eastern half (Fig. 2), but are indistinct in the western half (Fig. 3).

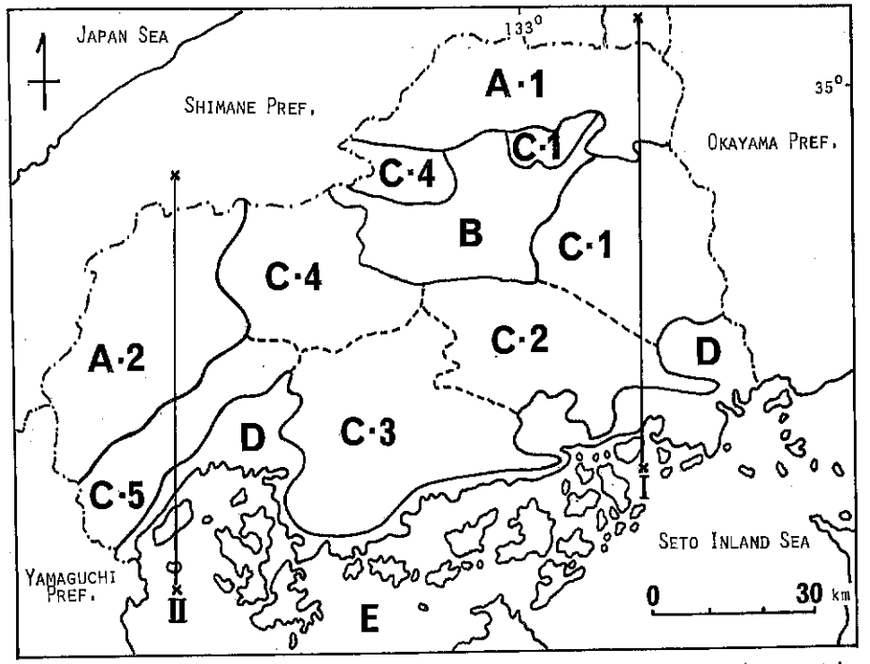

Fig. 1. Landform division of Hiroshima Prefecture (from Naruse 1977). A, mountain (A–1, Bihoku mountain. A–2, Geihoku mountain). B, median basin (Miyoshi basin). C, plateau (C–1, Jinseki plateau. C–2, Sera platform. C–3, Kamo platform. C–4, Takada plateau. C–5, Saeki–Toyohira plateau). D, plain. E, islands.

Distribution maps of the average annual temperature and of the average annual precipitation (Yoshida 1977) are shown in Figs. 4 and 5 respectively. Generally speaking, the lowlands belong to the warm-temperate zone, the middle elevations to the mixed-temperate zone and the higher elevations to the cool-temperate zone. The precipitation is somewhat scanty in the southeastern areas, but is rich including snowfall in the northwestern areas.

Geologically, acidic rocks such as granite and rhyolite are laid in almost entire areas, and andesite or Palaeozoic formations are scattered locally. The distribution of the main rocks iu this prefecture ls shown in Figs. 6, 7, 8 and 9, which were translated into the mesh-maps from the geological map of Hiroshima Prefecture at a scale of 1: 200,000 by the method described later.

The original natural vegetation in Hiroshima Prefecture is generally regarded to have consisted of three types of forest: the evergreen broad-leaved forest in the warm-temperate zone, the intermediate conifer forest in the mixed-temperate zone and the deciduous broad-leaved forest in the cool-temperate zone (Horikawa 1968). In the present time, however, such natural forests have mostly been destroyed and replaced by substitutional communities such as secondary forests, plantations, arable- or grassland and others. Most areas are occupied by secondary forests, cut-over forests and plantations, and they are estimated to cover as wide as about 99% of the forest areas in this

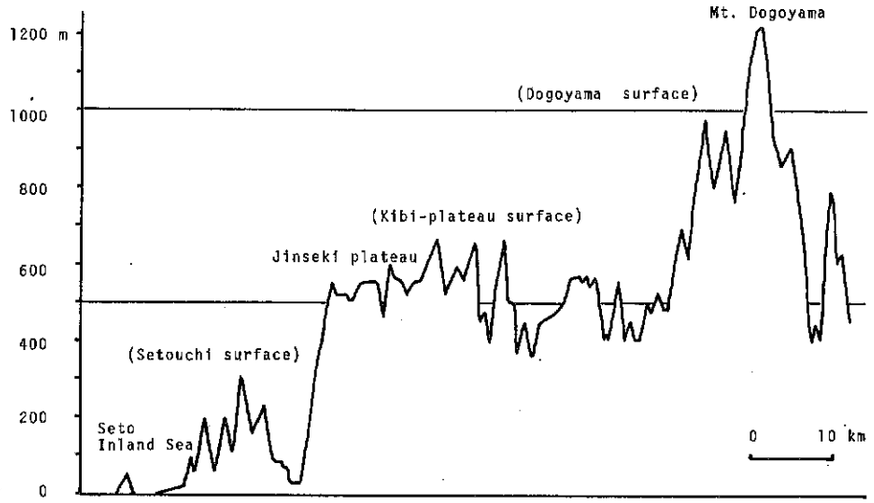

Fig. 2. A cross-section of the Chugoku mountains in the N–S direction at the eastern part of Hiroshima Prefecture. (Refer to line I in Fig. 1).

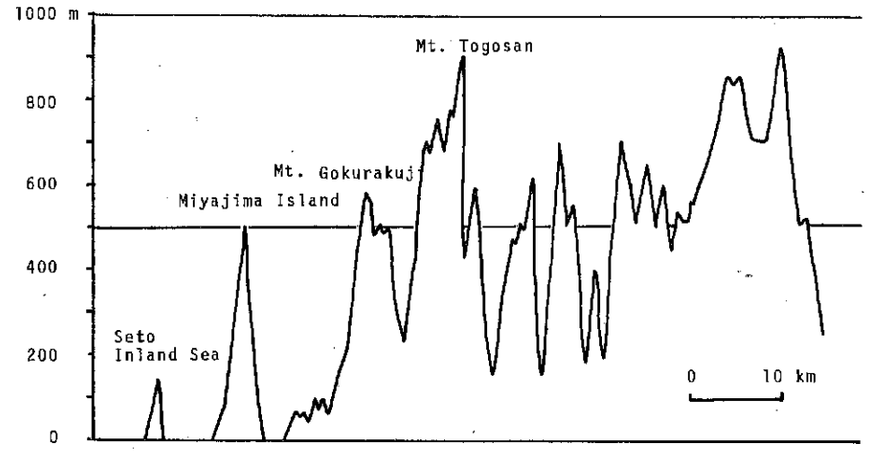

Fig. 3. A cross-section of the Chugoku mountains in the N–S direction at the western part of Hiroshima Prefecture. (Refer to line II in Fig. 1).

prefecture (Table 1). It is difficult to know precisely the potential geographical range of the natural forests by remaining ones alone, but it may be estimated from the results of studies on the secondary forests and plantations.

The pine secondary forests occupy the major part of forest vegetation in this prefecture. They are dominant in the southern half, but are less common in the northern half where they show a mosaic occurrence together with deciduous broad-leaved secondary forests.

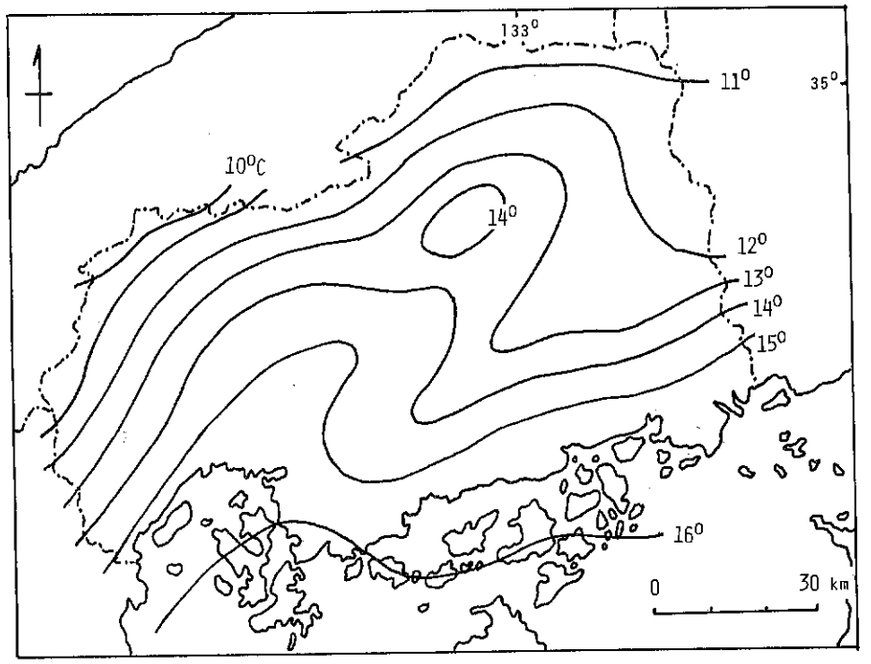

Fig. 4. A map showing the distribution of average annual temperatures (from Yoshida 1977).

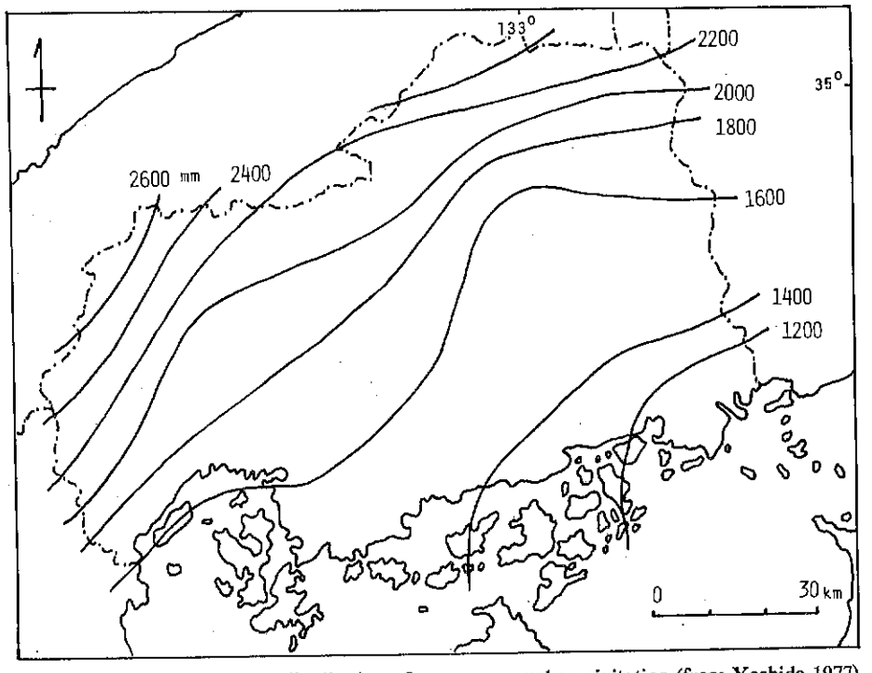

Fig. 5. A map showing the distribution of average annual precipitation (from Yoshida 1977).

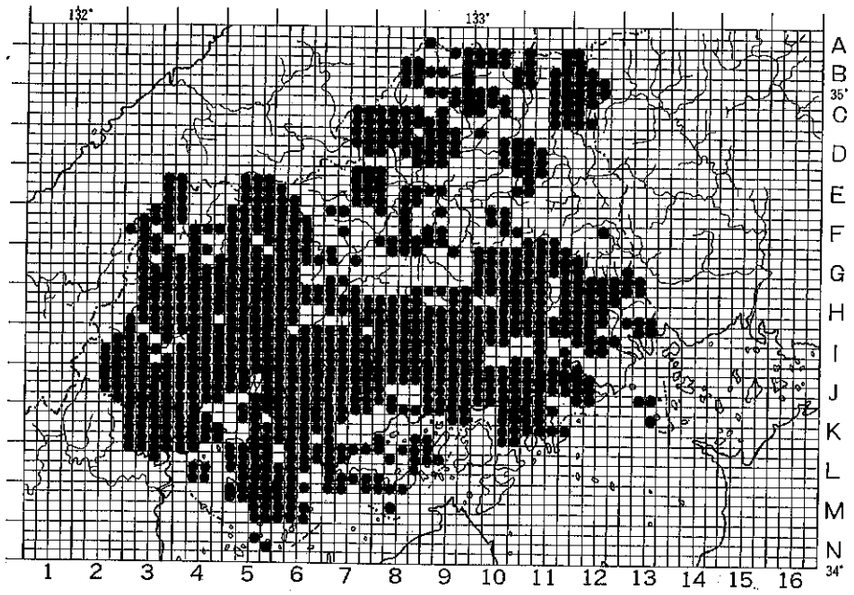

Fig. 6. A map showing the distribution of granite.

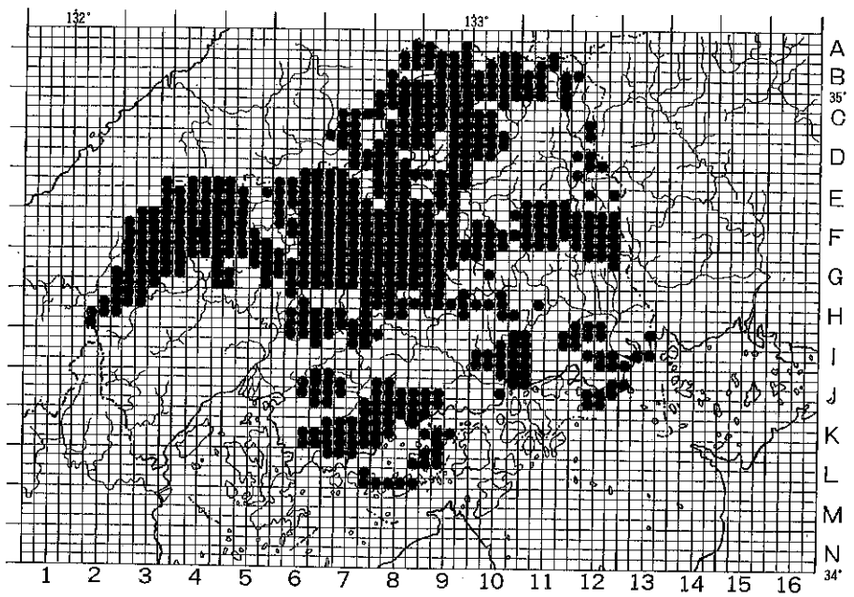

Fig. 7. A map showing the distribution of rhyolite.

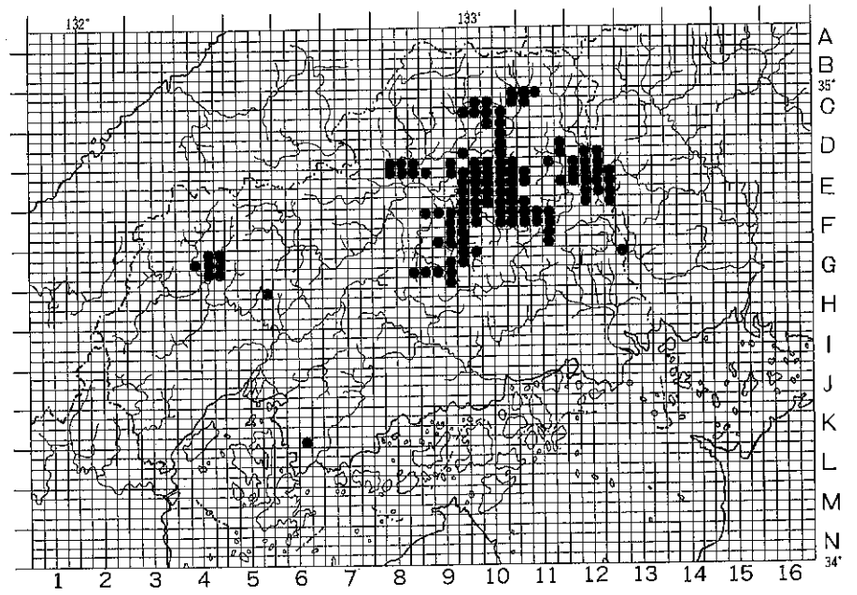

Fig. 8. A map showing the distribution of andesite.

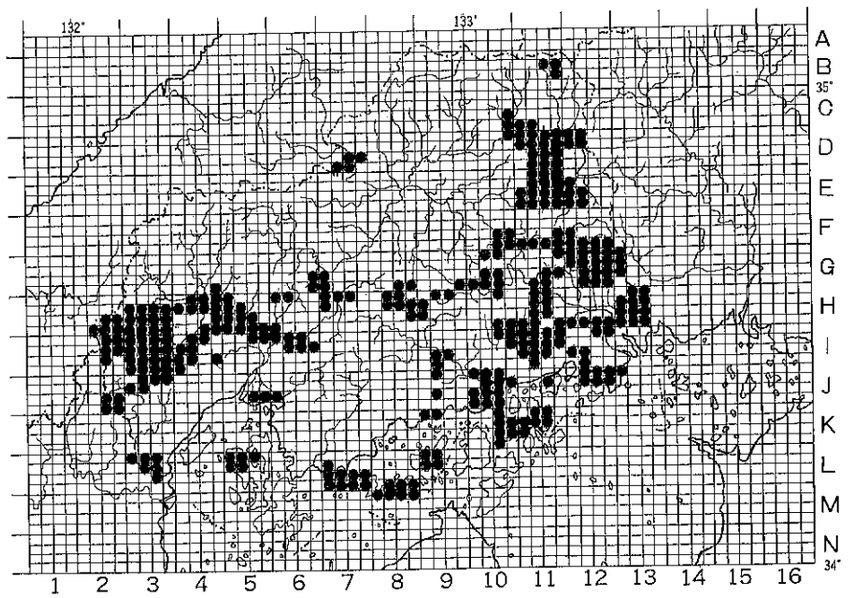

Fig. 9. A map showing the distribution of Palaeozoic formations.

Table 1. Composition of major forest vegetation units of Hiroshima Prefecture (percentage of each unit to total forest area)

Natural forest	0.5%*	
Deciduous broad-leaved forest		0.3%
Intermediate conifer forest		0.2
Evergreen broad-leaved forest		+
Secondary forest	84.7	
Deciduous broad-leaved forest		18.7
Pinus densiflora forest		66.0
Cut-over forest	6.2	
Cryptomeria–Chamaecyparis plantation	8.6	

* Estimated from the actual vegetation map of Hiroshima Prefecture at a scale of 1: 200,000.

METHODS

In the present study, the phytosociological treatment was carried out by the method of the Zürich-Montpelier (ZM) school (Braun-Blanquet 1964; Ellenberg 1956; Mueller-Dombois & Ellenberg 1974). The size of sample plots was usually about 15 × 15 m, and the same size was also employed for the stands of cutover or fire. The shape of the plots was optionally changed in consideration of the homogeneity of communities. The vegetation analysis included an estimate of the abundance-cover and sociability of all vascular plants, mosses and lichens appearing in the sample plot. Nomenclature

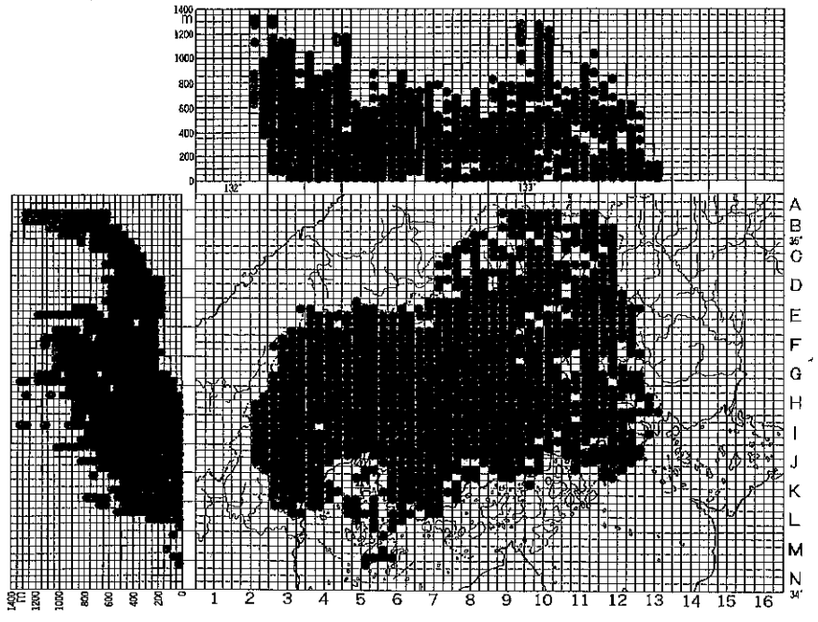

Fig. 10. A map showing the distribution of the stands investigated.

of species followed Ohwi (1975), Tagawa (1959), Iwatsuki and Mizutani (1972) and Yoshimura (1974) for seed plants, ferns, bryophytes and lichens, respectively.

The classification of communities was made on the basis of floristic criteria by the technique of tabular comparison (Ellenberg 1956). Sampled records used in this study were obtained between 1963 and 1983, and the distribution of meshes comprizing the stands investigated is shown in Fig. 10. The distribution of communities and rocks was expressed in mesh-maps, which are theoretically analogous to the three dimensional method devised by Horikawa (1963, 1972). In this study, the base-units of the mesh-map, corresponding to the geoquadrat in the method by Horikawa (1963, 1972), were settled in the following way: each unit area (10′Lat. × 15′Long.) of the topographic map at a scale of 1: 25,000 published by the Geographical Survey Institute was divided into sixteen equal parts to express the areal distribution, each corresponding to the rectanglar area of about 2.2 × 2.6 km, and two vertical profiles were employed to indicate the altitudinal distribution, shown at intervals of 50 m in altitude. The distribution maps of communities are very suggestive for drawing the phytosociological vegetation maps at a scale of 1: 50,000 or 1: 200,000. The more detail vegetation map at a scale of 1: 2,500 was made by the field survey. It was made based on the identification of the communities at the intervals of about 12.5 m in the field (5 mm on the map corresponds to 12.5 m in the field).

AN OUTLINE OF THE CLASSIFICATION OF JAPANESE PINE FORESTS

A Classification of the *Pinus densiflora* and the *P. thunbergii* forests in Japan was primarily undertaken by Yoshioka (1948, 1958). He mentioned that it was difficult to seek the character or differential species of associations, and classified the pine forests on the basis of both the dominant and the constant species. Another classification of the pine forests was presented by T. Suzuki (1966) in his preliminary system of the Japanese natural forest communities. He paid special attention to the ericaceous plants appearing characteristically in the pine forests. He described the associations characterized by several species of *Rhododendron*, and summarized them into an alliance *Pinion densiflorae* belonging to the order *Pinetalia densiflorae*. Later, Toyohara (1973) proposed a new system based on both the System by Yoshioka and by T. Suzuki, adding his original data.

These three systems are summarized in Table 2. However, they include many problems remaining unsolved and are not yet complete enough to be used as a standard. The associations in the sense of both T. Suzuki (1966) and Toyohara (1973) were characterized mainly by *Rhododendron kaempferi*, *R. macrosepalum*, *R. weyrichii*, *R. reticulatum* and *R. kiusianum*, respectively. The above-mentioned species of *Rhododendron* excepted *R. kaempferi* are distributed in a limited geographical area respectively, although every species ranges widely through the warm-, mixed- and cool-temperate zones. On the other hand, the associations in the system of Yoshioka (1958) are related both to the climatic zones and to the original natural forests, but the character or differential species of the associations were not determined.

The treatment by Toyohara (1973), made by combining the systems of Yoshioka

Table 2. Three systems of the classification of Japanese pine forests

K. Yoshioka (1958)
Cool-temperate pine forest
Pinus densiflora–Quercus serrata association
Pinus densiflora–Cornus controversa association
Pinus densiflora–Alnus pendula association
Pinus thunbergii–Quercus mongolica var. *grosseserrata* association
Warm-temperate pine forest
Pinus densiflora–Quercus (*Cyclobalanopsis*) *glauca* association
Pinus densiflora–Tsuga sieboldii association
Pinus thunbergii–Machilus thunbergii association
T. Suzuki (1966)
Order: *Pinetalia densiflorae* Suz.-Tok. 1966
Alliance: *Pinion densiflorae* Suz.-Tok. 1966
Association: *Rhododendro-Pinetum azumanum* Suz.-Tok. 1966
Association: *Rhododendro-Pinetum kinkianum* Suz.-Tok. 1966
Association: *Rhododendro-Pinetum weyrichii* Suz.-Tok. 1964
Association: *Rhododendro-Pinetum kiusiani* Oda et Sumata 1962
G. Toyohara (1973)
Order: *Pinetalia densiflorae* Suz.-Tok. 1966
Alliance: *Querco-Pinion densiflorae* H. Suzuki et Toyohara 1971
Suballiance: *Juniperus conferata* suball.
Association: *Pinus thunbergii–Imperata cylindrica* var. *coenigii* ass.
Association: *Pinus densiflora–Chrysanthemum yezoense* ass.
Suballiance: Typical suballiance
Association: *Pinus densiflora–Prunus verecunda* ass.
Association: *Rhododendro-Pinetum kiusiani* Oda et Sumata 1962
Association: *Rhododendro-Pinetum azumanum* Suz.-Tok. 1966
Alliance: *Cyclobalanopsio-Pinion densiflorae* H. Suzuki et Toyohara 1971
Suballiance: *Pieris japonica* suball.
Association: *Rhododendro-Pinetum weyrichii* Suz.-Tok. 1964
Association: *Rhododendro reticulati-Pinetum densiflorae* H. Suzuki et Toyohara 1971
Association: *Rhododendro-Pinetum kinkianum* Suz.-Tok. 1966
Suballiance: *Cinnamomum camphora* suball.
Association: *Pinus densiflora-Ilex chinensis* ass.
Association: *Pinus thunbergii-Machilus thunbergii* ass.

(1958) and T. Suzuki (1966), seems somewhat unreasonable because these two systems, from which Toyohara's treatment was derived, were based on quite different criteria.

A CLASSIFICATION OF PINE FORESTS IN HIROSHIMA PREFECTURE

Several phytosociological studies have hitherto been made on the pine forests in Hiroshima Prefecture. Horikawa (1942), Suzuki et al. (1970), Suzuki et al. (1975) and some others studied in detail the pine forest of Miyajima Island, located in the western

corner of the prefecture, and Suzuki and Toyohara (1971) described the *Rhododendro reticulati-Pinetum densiflorae* with reference to the warm-temperate pine forest in Hiroshima Prefecture. Toyohara and Suzuki (1975), on the basis of a study of the pine forest of the Sanyo district, published the *Symploco-Pinetum densiflorae* from Miyajima Island, separating it from the *Rhododendro reticulati-Pinetum densiflorae*. Toyohara (1979) described the association *Davallio-Pinetum densiflorae* belonging to the alliance *Cladonio-Pinion densiflorae*, based on a study of the natural pine forests developed on rocky sites in the prefecture.

In the present study, associations of the pine forests are defined according to the sense of Yoshioka (1958). Associations characterized by *Rhododendron* spp. are not fundamentally adopted. The ericaceous plants, noticed by T. Suzuki (1966), are treated as character or differential species of the order *Pinetalia densiflorae*. The pine forest communities recognized in Hiroshima Prefecture are summarized, with their neighboring communities, in Table 3. They are classified into ten associations, and are unified into three alliances and into one order. Each association is further divided into several subassociations.

Synopsis of the secondary forests in Hiroshima Prefecture

Order: *Pinetalia densiflorae* Suz.-Tok. 1966

I. Alliance: *Cladonio-Pinion densiflorae* Toyohara 1979

I–1. Association: *Cladio aggregatae-Pinetum densiflorae*, ass. nov.

I–1–A. Subassociation: *Juniperetosum rigidae*

I–1–B. Subassociation: *Dicranopteridetosum linearis*

I–1–C. Subassociation: *Acanthopanacetosum sciadophylloidis*

I–2. Association: *Davallio-Pinetum densiflorae* Toyohara 1979

I–2–A. Subassociation: *Quercetosum glaucae*

I–2–B. Subassociation: *Quercetosum grosseserratae*

II. Alliance: *Cyclobalanopsio-Pinion densiflorae* Suzuki et Toyohara 1971

II–1. Association: *Symploco-Pinetum densiflorae* Toyohara et Suzuki 1975

II–1–A. Subassociation: *Myrsinetosum seguinii*

II–1–B. *Myrsine–Quercus* transitional community

II–1–C. Subassociation: *Quercetosum acutae*

II–2. Association: *Querco phillyraeoidis-Pinetum densiflorae*, ass. nov.

II–3. Association: *Querco glaucae-Pinetum densiflorae* (Yoshioka 1958)

II–3–A. Subassociation: *Juniperetosum rigidae*

II–3–B. Subassociation: *Dicranopteridetosum linearis*

II–3–C. Subassociation: *Evodiopanacetosum innovantis*

II–4. Association: *Querco salicinae-Pinetum densiflorae*, ass. nov.

II–4–A. Subassociation: *Dicranopteridetosum linearis*

II–4–B. Subassociation: *Hydrangetosum luteo-venosae*

II–5. Association: *Querco myrsinaefoliae-Pinetum densiflorae*, ass. nov.

II–5–A. Subassociation: *Acanthopanacetosum sciadophylloidis*

II–5–B. Subassociation: *Vaccinietosum japonici*

III. Alliance: *Querco-Pinion densiflorae* Suzuki et Toyohara 1971

III–1. Association: *Tsugio sieboldii-Pinetum densiflorae* (Yoshioka 1958)
III–2. Association: *Rhododendro japonici-Pinetum densiflorae*, ass. nov.
III–3. Association: *Querco grosseserratae-Pinetum densiflorae* (Yoshioka 1958)

Deciduous broad-leaved secondary forests belonging to other order

IV. Association: *Castaneo-Quercetum crispurae* Horikawa et Sasaki 1959
IV–1. *Quercus monogolica* var. *grosseserrata–Castanea crenata* community
IV–2. *Quercus mongolica* var. *grosseserrata–Fagus crenata* community
V. *Quercus variabilis* community

Order: *Pinetalia densiflorae* Suz.-Tok. 1966

This order was originally described by T. Suzuki (1966), who selected, as character species of the order, *Pinus densiflora*, *Lyonia ovalifolia* var. *elliptica*, *Smilax china*, *Amelanchier asiatica*, *Rhododendron* spp., *Cladonia rangiferina* and *Cladonia arbuscula* ssp. *beringiana*.

In the area treated here the order is characterized by the species group 27 in Table 3, which includes *Pinus densiflora*, *Quercus serrata*, *Lyonia ovalifolia* var. *elliptica*, *Smilax china*, *Rhododendron reticulatum*, *R. kaempferi*, *Vaccinium oldhamii*, *Pteridium aquilinum* var. *latiusculum*, *Miscanthus sinensis*, *Lespedeza bicolor* and *Amelanchier asiatica*. The order is defined here as it includes the edaphic climax forest, secondary forest, initial forest and plantation dominated by *Pinus densiflora*, sometimes, also the forest dominated by deciduous or evergreen broad-leaved trees such as *Quercus serrata* and *Q. glauca*. It is concluded that this order is characterized by sun trees such as the components of the secondary forests and by ericaceous plants, and also by sun plants such as those growing in the grasslands.

This order is composed of three alliances: the *Cladonio-Pinion densiflorae*, *Cyclobalanopsio-Pinion densiflorae* and the *Querco-Pinion densiflorae*.

I. Alliance: *Cladonio-Pinion densiflorae* Toyohara 1979

This was originally described by Toyohara (1979) from Hiroshima Prefecture. The character or differential species of the alliance are as follows: *Cladonia rangiferina*, *Cladia aggregata*, *Rhacomitrium canescens*, *Campylopus richardii*, *Wikstroemia sikokiana* and *Melampyrum laxum* var. *nikkoense*.

This alliance includes the natural pine forest developed as an edaphic climax and its secondary forests on poor sites such as rocky ridges, arid lands of heavily weatherd granitic rocks and the marginal parts of moors. The pine forests belonging to this alliance have not been exploited by forestry because the growth of trees is usually very slow here. They are characterized by having such lichens as *Cladonia* in the moss layer. This alliance is composed of two associations associated with different edaphic conditions.

I–1. *Association*: Cladio aggregatae-Pinetum densiflorae, *ass. nov.*

Synonym: *Rhododendro reticulati-Pinetum densiflorae* Suzuki et Toyohara 1971, p.p.

Character or differential species: *Arundinella hirta*, *Haloragis micrantha*, *Polygara japonica*.

Type record: the same as that recorded for the subassociation of *Dicranopteridetosum linearis*.

This association is developed mainly on dry sites of heavily weathered granitic rocks or clayey sediments in areas of the Tertiary or the Quarternary System. Some examples of this association may be considered as an edaphic climax and some others may be secondary forests on poor and open sites. It is difficult to distinguish floristically the edaphic climax from the secondary forest. Most of the pine forests of this association have not been managed for forestry because of no economic value. Some of them are seen as cutover forests.

Most of them, however, are considered to have been derived from the over-exploitation of the secondary pine forests from ancient times. In other words, this is a degradated community in secondary succession induced by cutting, erosion of soil or fire.

This association is subdivided into the following three subassociations.

I–I–A. Subassociation: *Juniperetosum rigidae*

This is distinguished from other subassociations by having the species group 11 and lacking the groups 16, 25, and 26 as shown in Table 3. It is developed on dry sites in coastal areas, and the vertical range of its stands lies between 40 and 200 m (Fig. 11).

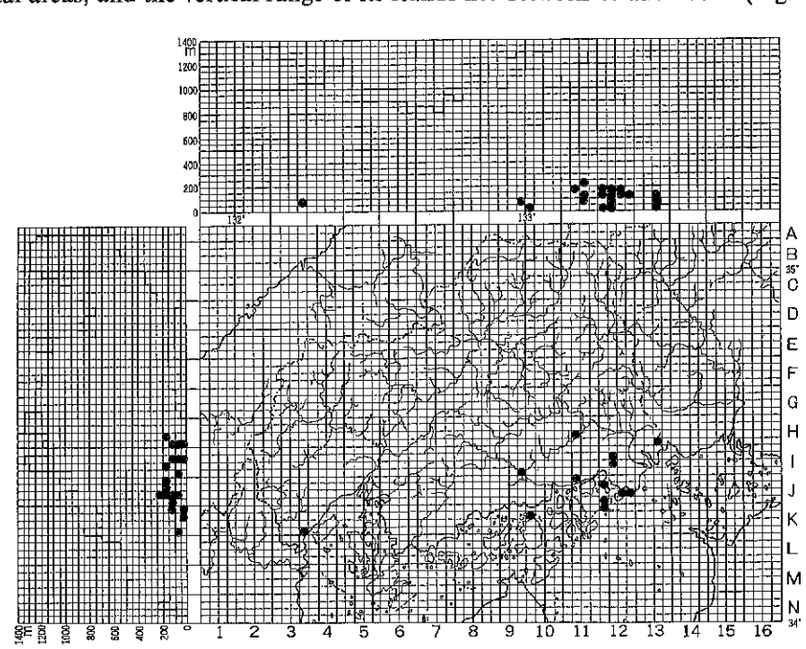

Fig. 11. A map showing the distribution of the *Cladio aggregatae-Pinetum densiflorae juniperetosum rigidae*.

Type record: St. no. 173, Akasaka-cho, Fukuyama City, Hiroshima Prefecture, 9 June, 1967. Altitude: 100 m; slope aspect: S50°E; slope degree: 25°, microtopography: ridge; mother rock: granite.
Tree layer: 4 m, 80%, DBH of the largest tree: 10 cm. 5.5 *Pinus densiflora*.
Shrub layer: 1.5 m, 90%. 3.4 *Juniperus rigida*, 3.4 *Rhododendron reticulatum*, 2.2 *Lyonia ovalifolia*

var. *elliptica*, 2.2 *Eurya japonica*, 2.2 *Vaccinium oldhamii*, 1.1 *V. blacteatum*, 1.1 *Pinus densiflora*, 1.1 *Lespedeza bicolor*, 1.1 *Abelia serrata*, 1.1 *Rhododendron kaempferi*, +.1 *Smilax china*, +.1 *Viburnum wrightii*.

Herb layer: 0.5 m, 50%. 2.2 *Rhododendron reticulatum*, 2.2 *R. kaempferi*, 2.2 *Juniperus rigida*, 1.2 *Lyonia ovalifolia* var. *elliptica*, 1.2 *Vaccinium oldhamii*, 1.2 *Miscanthus sinensis*, 1.2 *Dicranopteris linearis*, 1.2 *Arundinella hirta*, +.2 *Haloragis micrantha*, +.2 *Zoysia japonica*, +.1 *Quercus serrata*, (+.1) *Q. glauca*, +.1 *Pinus densiflora*, +.1 *Arundinaria pygmaea*, +.1 *Smilax china*.

Moss layer: 60%. 3.4 *Cladia aggregata*, 2.3 *Cladonia rangiferina*, 1.2 *C. crispata*, 1.2 *C. calycantha*, 1.2 *C. pleurota*, 1.2 *Hypnum plumaeforme*, +.2 *Leucobryum neilgherrense*.

I–I–B. Subassociation: *Dicranopteridetosum linearis*

This subassociation is distinguished from the others by having the species groups 11, 16, 25 and 26. It is widely found in coastal areas, and its vertical range lies between 50 and 500 m (Fig. 12).

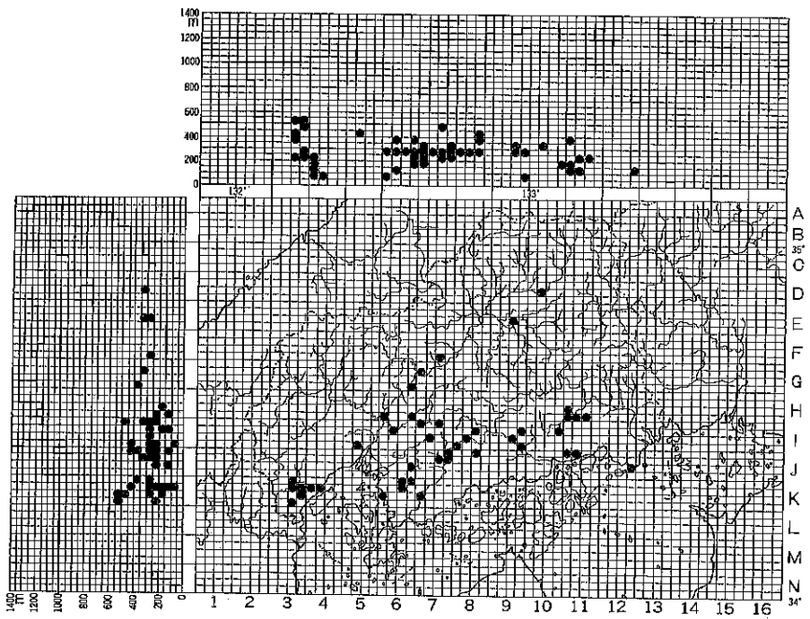

Fig. 12. A map showing the distribution of the *Cladio aggregatae-Pinetum densiflorae dicranopteridetosum linearis*.

Type record: St. no. 145, Tamari-cho, Takehara City, Hiroshima Prefecture, 29 May, 1967. Altitude: 400 m; slope aspect: S60°E; slope degree: 20°, microtopography: top; mother rock: granite.

Tree layer: 5 m, 70%; DBH of the largest tree; 10 cm. 4.4 *Pinus densiflora*, 1.1 *Ilex pedunculosa*.

Shrub layer: 1.5 m, 90%. 3.4 *Juniperus rigida*, 3.4 *Ilex pedunculosa*, 2.2 *Eurya japonica*, 2.2 *Quercus serrata*, 2.2 *Vaccinium oldhamii*, 2.2 *Pieris japonica*, 2.2 *Ilex crenata*, 2.2 *Rhododendron reticulatum*, 1.2 *R. kaempferi*, +.1 *Rhus trichocarpa*, +.1 *Smilax china*, (+.1) *Vaccinium bracteatum*.

Herb layer: 0.4 m, 60%. 3.2 *Arundinaria pygmaea*, 1.2 *Miscanthus sinensis*, 1.1 *Smilax china*, 1.1 *Pieris japonica*, 1.1 *Rhododendron kaempferi*, 1.1 *Arundinella hirta*, +.1 *Pteridium aquilinum* var. *latiusculum*, +.1 *Pinus densiflora*, +.1 *Juniperus rigida*, +.1 *Vaccinium oldhamii*, +.1 *Castanea crenata*, +.1 *Rhus trichocarpa*, +.1 *Prunus jamasakura*, +.1 *Polygala japonica*, +.1 *Solidago virga-aurea* var. *asiatica*, +.1 *Platanthera minor*, +.1 *Themeda japonica*, +.1 *Melampyrum laxum* var. *nikkoense*.

Moss layer: 60%. 3.4 *Cladia aggregata*, 3.4 *Cladonia rangiferina*, 1.2 *C. grayi*, 1.2 *C. floerkeana*, +.2 *C. cryptochloropaea*, 1.2 *Hypnum plumaeforme*, 1.2 *Rhacomitrium canescens*, 1.2 *Campylopus richardii*, +.2 *Leucobryum neilgherrense*.

I–I–C. Subassociation: *Acanthopanacetosum sciadophylloidis*

This is distinguished from the others by having the species groups 16, 25 and 26, but lacking 11. It is developed on dry sites in inland areas or somewhat higher elevations, ranging from 170 m to 550 m (Fig. 13).

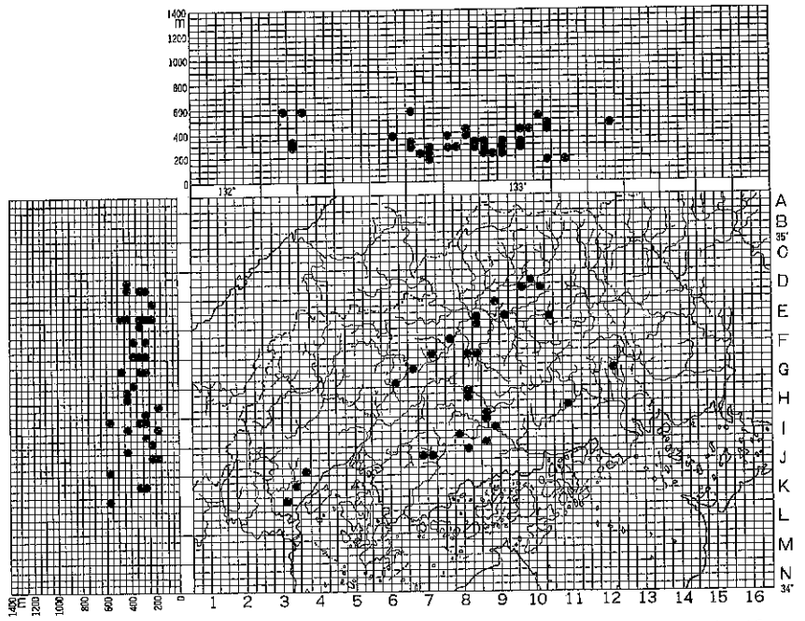

Fig. 13. A map showing the distribution of the *Cladio aggregatae-Pinetum densiflorae acanthopanacetosum sciadophilloidis*.

Type record: St. no. 295, Nishisakaya-machi, Miyoshi City, Hiroshima Prefecture, 17 Aug., 1968. Altitude: 290 m; slope aspect: S40°E; slope degree: 5°; Microtopography: ridge; mother rock: Tertiary formations.

Tree layer: 6 m, 60%; DBH of the largest tree: 7 cm. 4.4 *Pinus densiflora*.

Subtree layer: 4 m, 30%. 2.2 *Ilex pedunculosa*, 1.1 *Quercus variabilis*.

Shrub layer: 2 m, 60%. 3.4 *Ilex pedunculosa*, 2.2 *Eurya japonica*, 2.2 *Juniperus rigida*, 1.2 *Rhododendron reticulatum*, 1.1 *Vaccinium oldhamii*, 1.1 *Quercus serrata*, 1.2 *Pieris japonica*, +.1 *Pinus densiflora*, +.1 *Rhus trichocarpa*, +.1 *Lyonia ovalifolia* var. *elliptica*, +.1 *Ilex crenata*, +.1 *I. macropoda*, +.1 *I. serrata*, +.1 *Smilax china*, +.1 *Lespedeza bicolor*, (+.1) *Symplocos coreana*.

Herb layer: 0.6 m, 85%. 5.5 *Sasa septentrionalis* var. *membranacea*, 1.2 *Rhododendron reticulatum*, 1.2 *R. kaempferi*, 1.2 *Miscanthus sinensis*, 1.2 *Metanarthecium luteo-viride*, +.2 *Haloragis micrantha*, +.2 *Polygala japonica*, +.1 *Lyonia ovalifolia* var. *elliptica*, +.1 *Eurya japonica*, +.1 *Rhus trichocarpa*, +.1 *Pinus densiflora*, +.1 *Juniperus rigida*, +.1 *Ilex crenata*, +.1 *Viburnum wrightii*, +.1 *Vaccinium smallii* var. *glabrum*, +.1 *Solidago virga-aurea* var. *asiatica*, +.1 *Cymbidium goeringii*, +.1 *Ixeris dentata*, +.1 *Swertia japonica*.

Moss layer: 60%. 2.2 *Cladia aggregata*, 3.4 *Cladonia rangiferina*, 1.2 *C. arbuscula* ssp. *beringiana*, +.2 *C. pleurota*, +.2 *Dicranum scoparium*, +.2 *Hypnum plumaeforme*, +.2 *Campylopus richardii*, +.2 *Rhacomitrium canescens*.

I–2. *Association*: Davallio-Pinetum densiflorae *Toyohara 1979*

This association was originally described by Toyohara (1979) based on the natural pine forest of Hiroshima Prefecture. As character species of the association, he selected *Davallia mariesii*, *Rhododendron mucronulatum* var. *ciliatum*, *Repisorus thunbergii*, *Bulbophyllum drymoglossum* and *Dendrobium moniliforme*. In the present study, additional differential species of the association have been recognized: they include *Tripetaleia paniculata*, *Sorbus gracilis*, *Mecodium polyanthus*, *Enkianthus cernuus* f. *rubens* and *Hymenophyllum barbatum*.

This is developed as an edaphic climax forest on rocky or open sites such as rocky ridges, rocky outcrops, steep slopes and cliffs. The association resembles the *Pierideto-Tsugetum* (Yamanaka 1961) and also the *Illiceti-Tsugetum sieboldii* (Horikawa & Sasaki 1959) belonging to the order *Tsugetalia sieboldii* (T. Suzuki 1966). The tree layer is usually dominated by *Pinus densiflora*, sometimes by *Tsuga sieboldii* or *Chamaecyparis obtusa*. In both the subtree and the shrub layers, many ericaceous plants occur characteristically. In the herb layer, *Shortia soldanelloides* var. *magna* is often found, and some epilithic vascular plants such as orchids and ferns are also seen on exposed rocks. The distribution of the association is shown in Fig. 14.

Toyohara (1979) subdivided this association into two subassociations including four variants and seven subvariants.

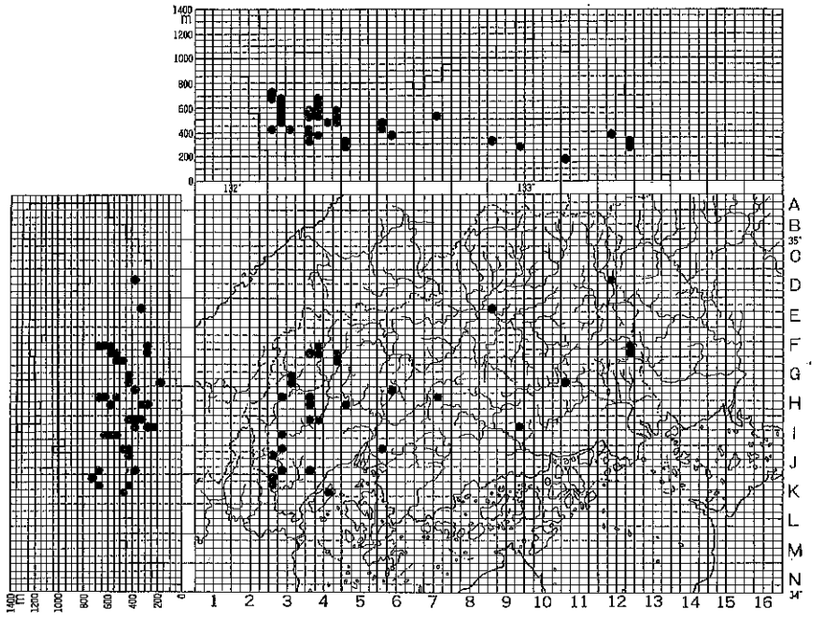

Fig. 14. A map showing the distribution of the *Davallio-Pinetum densiflorae*.

I–2–A. Subassociation: *Quercetosum glaucae*

This subassociation occupies the areas of lower elevations near the coast, and the vertical range of its stands lie between 190 and 510 m.

I–2–B. Subassociation: *Quercetosum grosseserratae*

This is developed in areas of rather high elevations, 400–700 m.

II. Alliance: *Cyclobalanopsio-Pinion densiflorae* Suzuki et Toyohara 1971

According to the system of Japanese pine forest by Toyohara (1973), character or differential species of this alliance include the following species: *Quercus glauca*, *Rhus sylvestris*, *Castanopsis cuspidata*, *Vaccinium bracteratum*, *Dicranopteris linearis*, *Gleichenia japonica*, *Ligustrum japonicum*, *Cinnamomum japonicum* and *Viburnum erosum*. This alliance is distinguished from other aliances by having the species groups 10, 11, 17, 18, 19 and 30, but lacking the groups 23 and 24 as shown in Table 3.

This alliance is composed of secondary pine forests developed in the warm-temperate zone and those in the lower part of the mixed-temperate zone. The tree layer is usually dominated by *Pinus densiflora*, sometimes by *Quercus serrata* or *Q. glauca*. Both the subtree and the shrub layers are dominated by evergreen broad-leaved trees and ericaceous plants such as *Rhododendron reticulatum*, *Lyonia ovalifolia* var. *elliptica* and *Pieris japonica*. The herb layer is usually dominated by *Dicranopteris linearis* and *Arundinaria pygmaea*. Species of evergreen broad-leaved trees composing the climatic climax forest are decreased in number by the intensive human impact. The degradation of the secondary forests is induced by over-expoloitation including fire, and it is further related to the edaphic and climatic conditions such as heavily weathered granitic rocks and the scarcity of precipitation.

This alliance is, in Hiroshima Prefecture, composed of five associations which are considered to have been derived from different communities of original natural forests.

II–1. *Association*: Symploco-Pinetum densiflorae *Toyohara et Suzuki 1975*

This association was originally described by Toyohara and Suzuki (1975) for the secondary pine forests of Miyajima Island in Hiroshima Prefecture. It is characterized by having *Illicium religiosum* and *Symplocos prunifolia*, and by lacking many plants commonly seen in the opposite mainland of Honshu. The association is characterized by the species groups 5 and 6 as shown in Table 3. A detailed discussion was made in the reports by Toyohara and Suzuki (1975) and Suzuki et al. (1975).

II–1–A. Subassociation: *Myrsinetosum seguinii*

This is found in lowlands of Miyajima Island. The original natural forest of the areas now occupied by this subassociation is assumed to have been the evergreen broad-leaved forest such as the *Symploco-Shiietum cuspidatae* Suz.-Tok. 1952.

II–1–B. *Myrsine–Quercus* transitional community

This is developed in the transitional zone between the two other subassociations.

II–1–C. Subassociation: *Quercetosum acutae*

This is developed in areas higher than about 300–400 m above sea-level on Miyajima Island. Secondary succession of this pine forest may progress to the intermediate conifer forest such as the *Illicio-Abietetum firmae* Suz.-Tok. 1961.

II–2. *Association*: Querco phillyraeoidis-Pinetum densiflorae, *ass. nov.*

Synonym: *Rhododendro reticulati-Pinetum densiflorae* Suzuki et Toyohara 1971 p.p.; *Rhododendro reticulati-Pinetum densiflorae*, subassociation of *Quercus phillyraeoides* Horikawa et al. 1976.

Character or differential species: *Quercus phillyraeoides, Myrica rubra.*

This is developed as a secondary forest on rocky sites near the sea coast. It is assumed that the original natural forest of the area occupied by this association may be the *Gleichenio-Quercetum phillyraeoidetis* Imai 1965 described as an edaphic climax or may be an evergreen broad-leaved secondary forest. The distribution of this association is shown in Fig. 15.

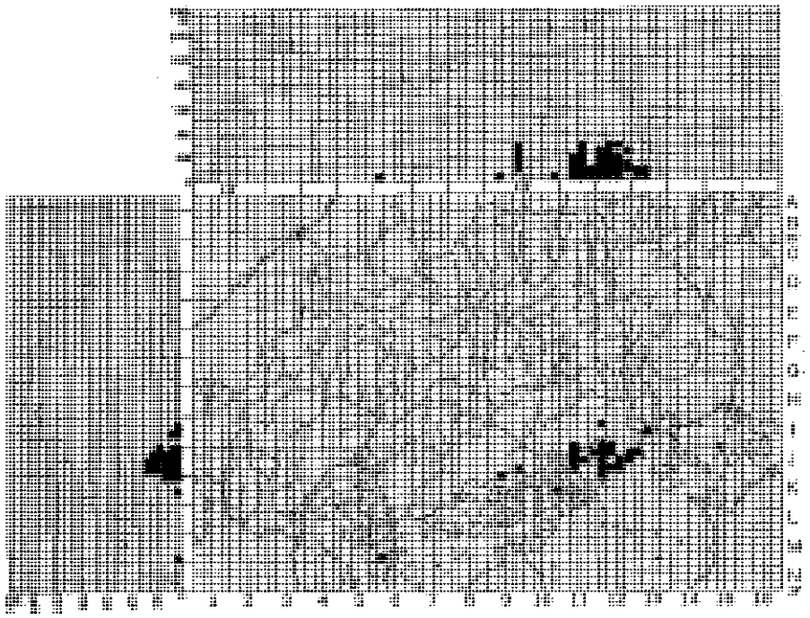

Fig. 15. A map showing the distribution of the *Querco phillyraeoidis-Pinetum densiflorae.*

Type record: St. no. 0–145, Sensuijima Island, Fukuyama City, Hiroshima Prefecture, 29 Aug., 1973. Altitude: 40 m, slope aspect: S10°W; slope degree: 25°; microtopography: middle part of slope; mother rock: rhyolite,

Tree layer: 6 m, 60%; DBH of the largest tree: 30 cm. 4.4 *Pinus densiflora.*

Subtree layer: 3 m, 85%. 3.4 *Quercus phillyraeoides*, 2.2 *Lyonia ovalifolia* var. *elliptica*, 2.2 *Juniperus rigida*, 1.2 *Myrica rubra*, +.1 *Rhus trichocarpa.*

Shrub layer: 1.5 m, 60%. 3.4 *Quercus phillyraeoides*, 2.2 *Vaccinium bracteatum*, 2.2 *Juniperus rigida*, 2.2 *Lyonia ovalifolia* var. *elliptica*, 2.2 *Rhododendron reticulatum*, 1.2 *Eurya japonica*, +.1 *Rhus trichocarpa.*

Herb layer: 0.6 m, 65%. 4.4 *Dicranopteris linearis*, 1.2 *Miscanthus sinensis*, 1.2 *Vaccinium bracteatum*, +.1 *Pittosporum tobira*, +.1 *Viburnum wrightii*, +.1 *Paederia scandens* var. *mairei.*

II–3. *Association*: Querco glaucae-Pinetum densiflorae (*Yoshioka 1958*)

Synonym: *Rhododendro reticulati-Pinetum densiflorae*, typical subass. Toyohara & Suzuki 1975; *Rhododendro reticulati-Pinetum densiflorae*, subassociation of *Acanthopanax sciadophylloides* Toyohara & Suzuki 1975 p.p.

Character or differential species: *Dicranopteris linearis, Vaccinium bracteatum, Symplocos lucida.*

Type record: the same as the record on the subassociation *Dicranopteridetosum linearis.*

When this association was originally described by Yoshioka (1948, 1958), character or differential species were not selected. In Hiroshima Prefecture, this association widely occupies the coastal areas lower than about 400 m. It is developed as a secondary forest in the warm-temperate zone. The original natural forest of the area occupied by this association is assumed to be the evergreen broad-leaved forests such as the *Castanopsis cuspidata–Pasania glabra* community. This association is subdivided into three subassociations.

II–3–A. Subassociation: *Juniperetosum rigidae*

This is distinguished from other subassociations by lacking the species groups 16, 25 and 26 as shown in Table 3. The most representative species of the secondary pine forest in Hiroshima Prefecture, such as *Pieris japonica, Ilex pedunculosa, Vaccinium*

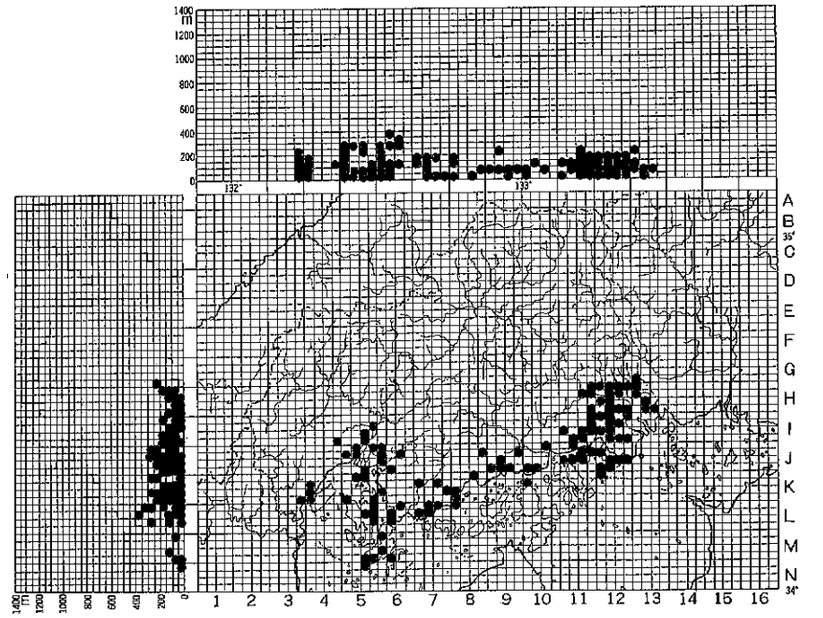

Fig. 16. A map showing the distribution of the *Querco glaucae-Pinetum densiflorae juniperetosum rigidae.*

smallii var. *glabrum*, *Rhamnus crenata* (species group 25) and *Ilex crenata*, *Clethra barbinervis* (species group 26) do not appear in this community. This subassociation is composed of two types of pine forest: one is the degradated type in the secondary succession which is induced by repeated fires, and the other is, inversely, the progressive type containing many components of the evergreen broad-leaved forest. Similar communities are found also in southern Japan. Relating to the classification of this community, however, probrems remain to be solved. This community is found in the coastal lowlands in Hiroshima Prefecture as shown in Fig. 16.

Type record: St. no. 99, Tenno-cho, Kure City, Hiroshima Prefecture, 29 Apr., 1967. Altitude: 250 m; slope aspect: S45°E; slope degree: 35°; microtopography: ridge; mother rock: granite.

Tree layer: 7 m, 90%; DBH of the largest tree: 20 cm. 5.5 *Pinus densiflora*, +.1 *Taxillus kaempferi*.

Shrub layer: 2.5 m, 80%. 3.4 *Rhododendron reticulatum*, 1.1 *R. kaempferi*, 2.2 *Eurya japonica*, 2.2 *Juniperus rigida*, 1.1 *Pinus densiflora*, 1.1 *Lyonia ovalifolia* var. *elliptica*, +.1 *Vaccinium bracteatum*, +.1 *Quercus serrata*, +.1 *Rhus trichocarpa*, +.1 *Amelanchier asiatica*, +.1 *Lespedeza bicolor*, +.1 *Smilax china*, +.1 *Ligustrum japonica*, +.1 *Abelia serrata*, +.1 *Pourthiaea villosa* var. *laevis*.

Herb layer: 0.4 m, 80%. 4.4 *Dicranopteris linearis*, 2.2 *Rhododendron reticulatum*, 1.1 *R. kaempferi*, 1.2 *Miscanthus sinensis*, +.1 *Solidago virga-aurea* var. *asiatica*, +.1 *Juniperus rigida*, +. *Viburnum erosum*.

II–3–B. Subassociation: *Dicranopteridetosum linearis*

This subassociation is distinguished from the others by having the species groups 25 and 26, but lacking the group 16 as shown in Table 3. It is the most typical secondary pine forest developing in the coastal areas, usually at elevations lower than about 400 m (Fig. 17). This will later be treated in detail.

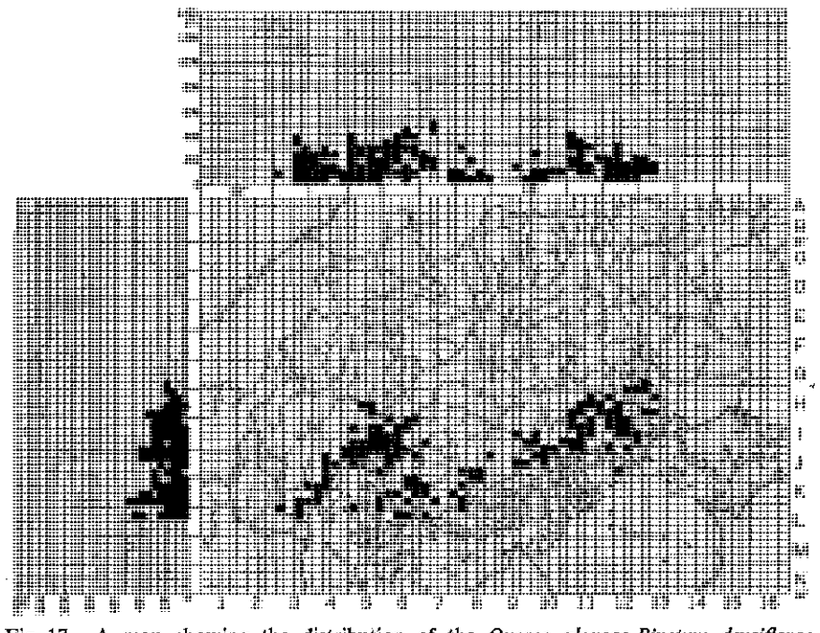

Fig. 17. A map showing the distribution of the *Querco glaucae-Pinetum densiflorae dicranopteridetosum linearis*.

Type record: St. no. 158, Ohno-cho, Saeki-gun, Hiroshima Prefecture, 2 June, 1967. Altitude: 20 m; slope aspect: E; slope degree: 20°; microtopography: ridge; mother rock: granite.

Tree layer: 15 m, 85%; DBH of the largest tree: 30 cm. 5.5 *Pinus densiflora*, 1.1 *Juniperus rigida*.

Subtree layer: 4 m, 35%. 2.2 *Lyonia ovalifolia* var. *elliptica*, 1.1 *Ilex pedunculosa*, 1.1 *Rhus trichocarpa*, 1.1 *Dendropanax trifidus*, 1.1 *Juniperus rigida*, 1.1 *Rhamnus crenata*, 1.1 *Symplocos lucida*, 1.1 *Eurya japonica*, 1.1 *Pinus densiflora*, 1.1 *Smilax china*.

Shrub layer: 2 m, 80%. 3.4 *Rhododendron reticulatum*, 3.4 *Eurya japonica*, 3.4 *Lyonia ovalifolia* var. *elliptica*, 2.2 *Pieris japonica*, 1.1 *Vaccinium bracteatum*, 1.1 *V. oldhamii*, 1.1 *Dendropanax trifidus*, 1.1 *Viburnum wrightii*, 1.1 *Pourthiaea villosa* var. *laevis*, +.1 *Camellia japonica*, +.1 *Quercus serrata*, +.1 *Symplocos lucida*, +.1 *Rhamnus crenata*, +.1 *Smilax china*.

Herb layer: 0.4 m, 95%. 5.5 *Dicranopteris linearis*, 1.1 *Rhododendron kaempferi*, +.1 *Symplocos lucida*, +.1 *Eurya japonica*, +.1 *Ilex crenata*, +.1 *Miscanthus sinensis*, +.1 *Ardisia japonica*, +.1 *Rhus trichocarpa*, +.1 *Dendropanax trifidus*, +.1 *Lespedeza bicolor*, +.1 *Pertya scandens*, +.1 *Pteridium aquilinum* var. *latiusculum*, +.1 *Abelia serrata*, +.1 *Smilax china*, +.1 *Melampyrum roseum* var. *japonicum*, +.1 *Viburnum wrightii*, +.1 *Ilex pedunculosa*.

Moss layer: 5%. +.1 *Brotherella henonii*, +.1 *Leucobryum neilgherrense*, +.1 *Herzogiella spinulosa*, +.1 *Calypogeia tosana*, +.1 *Isopterygium* sp.

II–3–C. Subassociation: *Evodiopanacetosum innovantis*

This subassociation is recognized by having the species groups 16, 25 and 26 as shown in Table 3. This is found in the coastal areas, but it occupies somewhat inner and higher regions compared to the preceding two subassociations (Fig. 18). It is more significantly distributed on the Kamo-platform (C–3 in Fig. 1). The community seems to occupy the transitional zone between the Setouchi surface and the Kibi-plateau surface. The distribution of this subassociation is shown in Fig. 18.

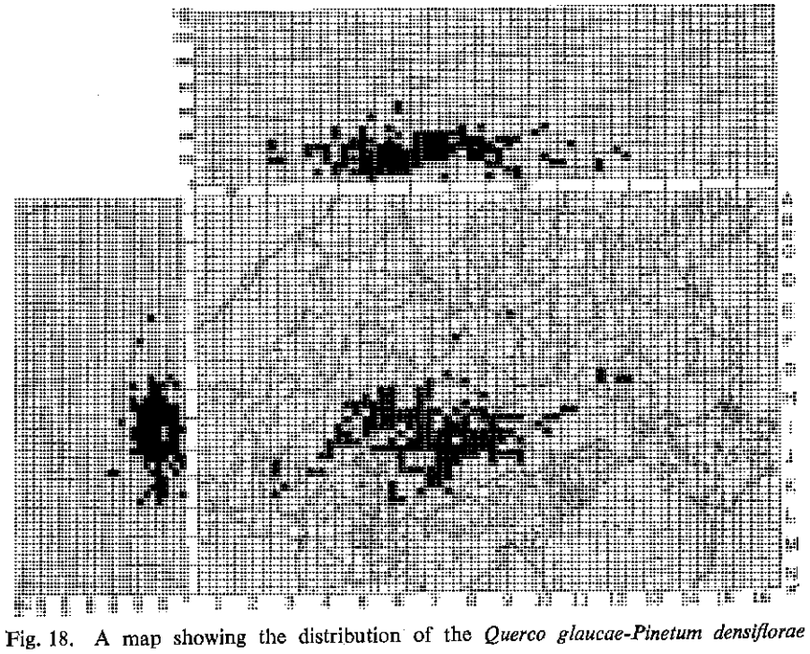

Fig. 18. A map showing the distribution of the *Querco glaucae-Pinetum densiflorae evodiopanacetosum innovantis*.

Type record: St. no. 288, Hachihonmatsu-cho, Higashi-hiroshima City, Hiroshima Prefecture, 8 Aug., 1968. Altitude: 230 m; microtopography: flatland; mother rock: granite.

Trec layer: 15 m, 75%; DBH of the largest tree: 30 cm. 5.5 *Pinus densiflora.*

Subtree layer: 5m, 90%. 3.4 *Lyonia ovalifolia* var. *elliptica*, 2.2 *Juniperus rigida*, 2.2 *Rhus trichocarpa*, 2.2 *Symplocos lucida*, 1.2 *Evodiopanax innovans*, 1.2 *Rhododendron reticulatum*, 1.1 *Eurya japonica*, 1.1 *Viburnum wrightii*, +1.1 *Ilex marcopoda*, +.1 *I. pedunculosa*, +.1 *Prunus jamasakura*, +.1 *Pieris japonica*, +.1 *Acanthopanax sciadophylloides*, +.1 *Styrax japonica.*

Shrub layer: 2 m, 50%. 3.2 *Eurya japonica*, 2.2 *Lyonia ovalifolia* var. *elliptica*, 2.2 *Symplocos lucida*, 1.2 *Rhododendron reticulatum*, 1.2 *Vaccinium oldhamii*, 1.1 *V. bracteatum*, +.1 *Acanthopanax sciadophylloides*, +.1 *Viburnum wrightii*, +.1 *Lespedeza bicolor*, +.1 *Ilex crenata*, +.1 *I. pedunculosa*, +.1 *Quercus variabilis.*

Herb layer: 0.5 m, 70%. 4.4 *Arundinaria pygmaea*, 2.2 *Eurya japonica*, 1.2 *Rhododendron kaempferi*, +.1 *Smilax china*, +.1 *Ilex crenata*, +.1 *I. serrata*, +.1 *Rhus trichocarpa*, +.1 *Vaccinium smallii* var. *grabrum*, +.1 *Evodiopanax innovans*, +.1 *Acanthopanax sciadophylloides*, +.1 *Miscanthus sinensis*, +.1 *Solidago virga-aurea* var. *asiatica*, +.1 *Stylax japonica*, +.1 *Wisteria floribunda*, +.1 *Symplocos lucida*, +.1 *Quercus glauca*, +.1 *Ardisia japonica*, +.1 *Viola violaceae*, +.1 *Juniperus rigida*, +.1 *Pteridium aquilinum* var. *latiusculum*, +.1 *Atractylodes japonica*, +.1 *Metanarthecium luteo-viride*, +.1 *Rosa multiflora*, +. 1 *Struthiopteris niponica.*

Moss layer: 7%. 1.2 *Brotherella henonii*, +.1 *Leucobryum neilgherrense*, +.1 *L. scabrum.*

II–4. *Association*: Querco salicinae-Pinetum densiflorae, *ass. nov.*

Synonym: *Rhododendro reticulati-Pinetum densiflorae, Acanthopanax sciadophylloides* subassociation, Toyohara & Suzuki 1975, p.p.

Character or differential species: *Quercus salicina, Hydrangea luteo-venosa, Illicium religiosum, Symplocos myrtacea, Parabenzoin trilobum, Quercus acuta, Q. sessilifolia.*

Type record: the same as the record on the subassociation *Hydrangetosum luteo-venosae.*

This secondary forest develops in the lower part of the mixed-temperate zone, and its original climax forest is assumed to be the intermediate conifer forest such as the *Illicio-Abietetum firmae.* This is more frequently distributed on the Saeki-Toyohira plateau (C–5 in Fig. 1) with somewhat steep slopes. It mainly occupies the area at elevations between 400 m and 700 m, including rare occurrences at elevation lower than 400 m. *Quercus salicina* frequently disappears in sites of over-exploitation.

II–4–A. Subassociation: *Dicranopterldetosum linearis*

This is distinguished from the next subassociation by having the species group 11 as shown in Table 3. This community represents a transitional type from the *Querco glaucae-Pinetum densiflorae* to the main type of this association. It is mainly distributed at elevations between 200 m and 600 m, centering about 400 m (Fig. 19).

Type record: St. no. 1751, Nabarakyô Gorge, Kabe-cho, Hiroshima City, Hiroshima Prefecture, 20 May, 1978. Altitude: 420 m; slope aspect: S; slope degree: 35°; microtopography: middle part of slope; mother rock: granite.

Tree layer: 12 m, 70%; DBH of the largest tree: 25 cm. 4.4 *Pinus densiflora.*

Subtree layer: 7 m, 85%. 3.3 *Clethra barbinervis*, 2.2 *Lyonia ovalifolia* var. *elliptica*, 2.2 *Quercus salicina*, 1.1 *Q. sessilifolia*, 1.1 *Q. glauca*, 1.1 *Q. serrata*, 1.1 *Ilex pedunculosa*, 1.1 *I. macropoda*, 1.1 *Styrax japonica.*

Shrub layer: 2 m, 45%. 2.2 *Illicium religiosum*, 2.2 *Rhododendron serpyllifolium*, 1.1 *R. reticulatum*,

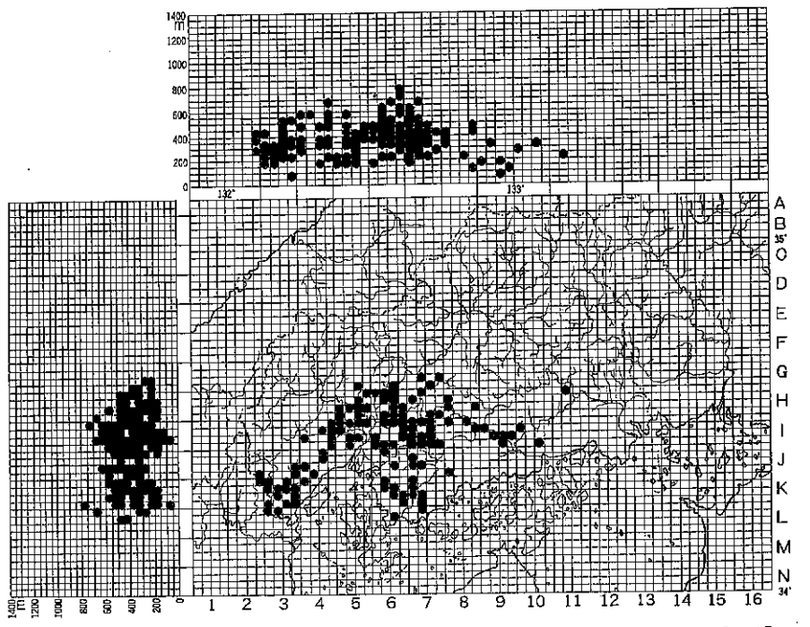

Fig. 19. A map showing the distribution of the *Querco salicinae-Pinetum densiflorae dicranopteridetosum linearis.*

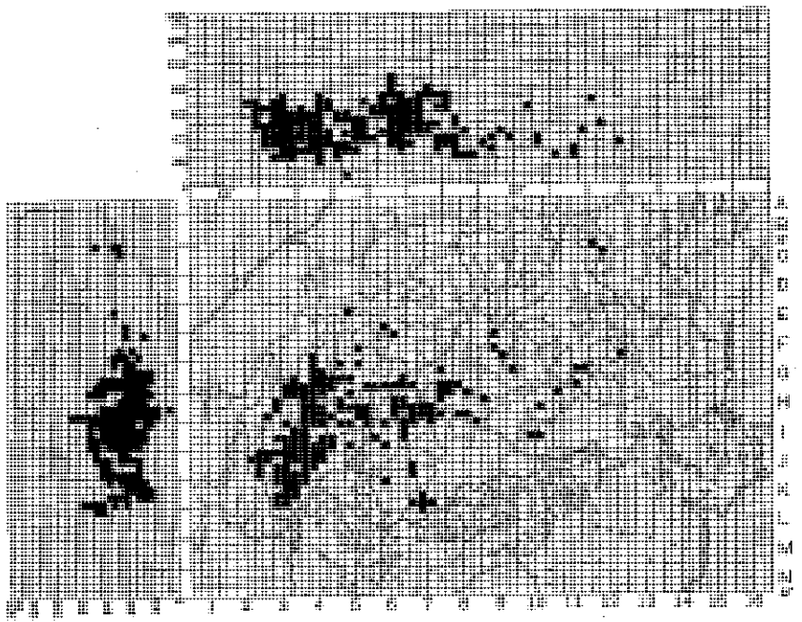

Fig. 20. A map showing the distribution of the *Querco salicinae-Pinetum densiflorae hydrangetosum luteo-venosae.*

1.1 *R. semibarbatum*, 2.2 *Cleyera japonica*, 1.1 *Eurya japonica*, 1.1 *Pieris japonica*, 1.1 *Camellia japonica*, +.1 *Pourthiaea villosa* var. *laevis*, +.1 *Rhus trichocarpa*, +.1 *Hydrangea hirta*, +.1 *Fraxinus sieboldiana*, +.1 *Viburnum wrightii*, +.1 *Acer crataegifolium*, +.1 *Clethra barbinervis*, +.1 *Callicarpa mollis*, +.1 *Quercus salicina*, +.1 *Sarcochilus japonicus*.

Herb layer: 0.6 m, 15%. 2.2 *Gleichenia japonica*, +.2 *Ardisia japonica*, +.1 *Vaccinium bracteatum*, +.1 *V. japonicum*, +.1 *Viburnum erosum*, +.1 *Viola violaceae*, +.1 *Hydrangea luteo-venosa*, +.1 *Quercus salicina*, +.1 *Lindella umbellata*, +.1 *Pieris japonica*, +.1 *Rhamnus crenata*, +.1 *Pteridium aquilinum* var. *latiusculum*, +.1 *Smilax china*, +.1 *Struthiopteris niponica*, +.1 *Neolitsea sericea*, +.1 *Ophiopogon japonicus*, (+,1) *Cymbidium goeringii*.

Moss layer: +. +.2 *Leucobryum neilgherrense*.

II–4–B. Subassociation: *Hydrangetosum luteo-venosae*

This is the representative type of the association, and recognized by lacking the species group 11 as shown in Table 3. The distribution of this community is shown in Fig. 20. It is characteristically seen on the Saeki-Toyohira plateau (C–5 in Fig. 1).

Type record: St. no. 2467, Saeki-cho, Saeki-gun, Hiroshima Prefecture, 22 May, 1983. Altitude: 460 m; slope aspect: S80°W; slope degree: 35°, microtopography: middle part of slope; mother rock: granite.

Tree layer: 17 m, 80%; DBH of the largest tree: 30 cm. 5.5 *Pinus densiflora*.

Subtree layer: 6 m, 70%. 2.2 *Eurya japonica*, 2.2 *Clethra barbinervis*, 2.2 *Ilex pedunculosa*, 1.2 *I. macropoda*, 2.2 *Quercus serrata*, 1.1 *Q. salicina*, 1.1 *Q. glauca*, 1.2 *Symplocos myrtacea*, 1.1 *Pieris japonica*, 1.1 *Lyonia ovalifolia* var. *elliptica*, 1.1 *Smilax china*, 1.1 *Pourthiaea villosa* var. *laevis*, 1.1 *Viburnum wrightii*, 1.1 *Stylax japonica*, 1.1 *Castanea crenata*, +.1 *Rhamnus crenata*, +.1 *Amelanchier asiatica*.

Shrub layer: 3 m, 90%. 3.4 *Eurya japonica*, 2.2 *Illicium religiosum*, 2.2 *Quercus salicina*, 1.1 *Q. glauca*, 1.1 *Q. serrata*, 2.2 *Rhododendron reticulatum*, 2.2 *Hydrangea luteo-venosa*, +.1 *H. hirta*, 1.1 *Pieris japonica*, 1.1 *Cleyera japonica*, 1.1 *Viburnum wrightii*, +.1 *V. erosum*, 1.1 *Vaccinium smallii* var. *glabrum*, 1.1 *V. oldhamii*, 1.1 *Callicarpa mollis*, +.1 *Evodiopanax innovans*, +.1 *Smilax china*, +.1 *Amelanchier asiatica*, +.1 *Wikstroemia sikokiana*, +.1 *Rhus trichocarpa*, +.1 *Pourthiaea villosa* var. *laevis*, +.1 *Parabenzoin trilobum*, +.1 *Cornus kousa*, +.1 *Prunus verecunda*.

Herb layer: 0.5 m, 10%. 1.2 *Hydrangea luteo-venosa*, +.1 *H. hirta*, +.2 *Ardisia japonica*, +.2 *Rhododendron reticulatum*, +.2 *Pertya scandens*, +.2, *Viola violacea*, +.1 *Magnolia salicifolia*, +.1 *Solidago virga-aurea* var. *asiatica*, +.1 *Melamphyrum laxum* var. *nikkoense* +.1 *Cinnamomum japonicum*, +.1 *Lindella umbellata*, +.1 *Pteridium aquilinum* var. *latiusculum*, +.1 *Paederia scandens* var. *mairei*, +.1 *Ophiopogon japonicus*, +.1 *Tripterospermum japonicum*, +.1 *Platanthera minor*, +.1 *Disporum smilacinum*, +. 1 *Vaccinium japonicum*, +.1 *Smilax nipponica*, +.1 *Synurus palmatopinnatifidus*, +.1 *Spodiopogon sibiricus*.

Moss layer: +. +.1 *Leucobryum neilgherrense*.

II–5. *Association*: Querco myrsinaefoliae-Pinetum densiflorae, *ass. nov.*

Synonym: *Rhododendro reticulati-Pinetum densiflorae, Acanthopanax sciadophylloides* subassociation, Toyohara & Suzuki 1975 p.p.

Character or differential species: *Quercus myrsinaefolia, Dioscorea gracillima, Prunus grayana, Maackia amurensis* var. *buergeri, Albizzia julibrissin*.

Type record: the same as the record on the subassociation *Acanthopanacetosum sciadophylloidis*.

This association is the secondary forest developing in inland areas, and its original natural forests are assumed to include both the *Quercetum myrsinaefolia* and the *Illicio-Abietetum firmae* which are developed in the warm- and the mixed-temperate zones

respectively. This is distributed on the Kibi-plateau surface comprising the Jinseki plateau, the Sera platform and the Takada plateau, and in the Miyoshi basin (Figs. 1, 21 and 22). *Quercus myrsinaefolia* frequently disappears by over-exploitation. However, the productivity of this association is usually good and forests of this association are being managed for forestry or agricultural use. This was treated by Suzuki & Toyohara (1971) and Toyohara (1978) in more detail.

II–5–A. Subassociation: *Acanthopanacetosum sciadophylloidis*

This subassociation is recognized by lacking the species group 13 as shown in Table 3. Its distribution is shown in Fig. 21.

Type record: St. no. 223, Honmachi, Shobara City, Hiroshima Prefecture, 17 Aug., 1967. Altitude: 420 m; slope aspect: S30°E; slope degree: 10°; microtopography: middle part of slope; mother rock: rhyolite.

Tree layer: 18 m, 80%; DBH of the largest tree: 30 cm. 5.5 *Pinus densiflora*, +.1 *Taxillus kaempferi*.

Subtree layer: 10 m, 90%. 4.4 *Acanthopanax sciadophylloides*, 3.4 *Ilex pedunculosa*, 1.1 *Acer crataegifolium*, 1.1 *Pourthiaea villosa* var. *laevis*, 1.1 *Kalopanax pictus*, 1.1 *Clethra barbinervis*, 1.1 *Lyonia ovalifolia* var. *elliptica*, 1.1 *Stylax japonica*.

Shrub layer: 3 m, 80%. 3.4 *Eurya japonica*, 3.4 *Rhododendron reticulatum*, 2.1 *Ilex pedunculosa*, +.1 *I. serrata*, 1.1 *Acer crataegifolium*, 1.1 *Acanthopanax sciadophylloides*, +.1 *Viburnum erosum*, +.1 *Pieris japonica*, +.1 *Sorbus japonica*, +.1 *Lindera umbellata*, +.1 *Lonicera gracilipes* var. *glabra*.

Herb layer: 0.7 m, 15%. 1.2 *Rhododendron kaempferi*, 1.2 *Ilex pedunculosa*, 1.2 *I. crenata*, 1.1 *Eurya japonica*, 1.1 *Acanthopanax sciadophylloides*, +.1 *Quercus myrsinaefolia*, +.1 *Dioscorea gracillima*, +.1 *Pertya scandens*, +.1 *Smilax china*, +.1 *Pieris japonica*, +.1 *Arundinaria pygmaea*, +.1 *Juniperus rigida*, +.1 *Pteridium aquilinum* var. *latiusculum*, +.1 *Disporum smilacinum*, +.1 *Prunus jamasakura*, +.1 *Cymbidium goeringii*, +.1 *Vaccinium oldhamii*, +.1 *Eupatrium chinense* var. *simplicifolium*, +.1 *Acer palmatum*, +.1 *A. crataegifolium*, +.1 *Ardisia japonica*, +.1 *Struthiopteris niponica*, +.1 *Tripterospermum japonicum*, +.1 *Carex ciliato-marginata*, +.1 *Pyrola japonica*, +.1 *Aster ageratoides* var. *semiamplexicaulis*, +.1 *Rhus trichocarpa*.

II–5–B. Subassociation: *Vaccinetosum japonici*

This subassociation is distinguished from the preceding one by having the species group 13 as shown in Table 3. Its distribution is similar to that of the preceding subassociation (Fig. 22), but it occurs generally at higher elevations.

Type record: St. no. 1085, Joge-cho, Kounu-gun, Hiroshima Prefecture, 22 Oct., 1976. Altitude: 430 m; slpe aspect: N20°W; slope degree: 20°; microtopography: middle part of slope; mother rock; granite.

Tree layer: 18 m, 75%; DBH of the largest tree: 30 cm. 5.5 *Pinus densiflora*.

Subtree layer; 6 m, 80%. 3.3 *Ilex pedunculosa*, 3.3 *Clethra barbinervis*, 1.1 *Quercus serrata*, 2.2 *Acanthopanax sciadophylloides*, 1.1 *Lyonia ovalifolia* var. *elliptica*, 1.1 *Acer crataegifolium*, 1.1 *Viburnum wrightii*.

Shrub layer: 2 m, 60%. 3.3 *Rhododendron reticulatum*, 2.2 *Pieris japonica*,, 1.2 *Eurya japonica*, 1.2 *Viburnum wrightii*, 1.2 *Hydrangea hirta*, 1.2 *Ilex crenata*, 1.1 *Lyonia ovalifolia* var. *elliptica*, 1.1 *Abelia serrata*, +.1 *Rhus trichocarpa*, +.1 *Prunus grayana*, +.1 *P. jamasakura*, +.1 *Ilex macropoda*, +.1 *Rhododendron kaempferi*, +1. *Vaccinium smallii* var. *glabrum*.

Herb layer: 0.5 m, 20%. 2.2 *Struthiopteris niponica*, 1.2 *Vaccinium japonicum*, 1.2 *Tripterospermum japonicum*, 1.2 *Ilex pedunculosa*, 1.2 *I. crenata*, 1.2 *Hydrangea hirta*, +.1 *Quercus myrsinaefolia*, +.1 *Q. serrata*, +.1 *Smilax china*, +.1 *Castanea crenata*, +.1 *Rhododendron kaempferi*, +.1 *Abies firma*, +.1

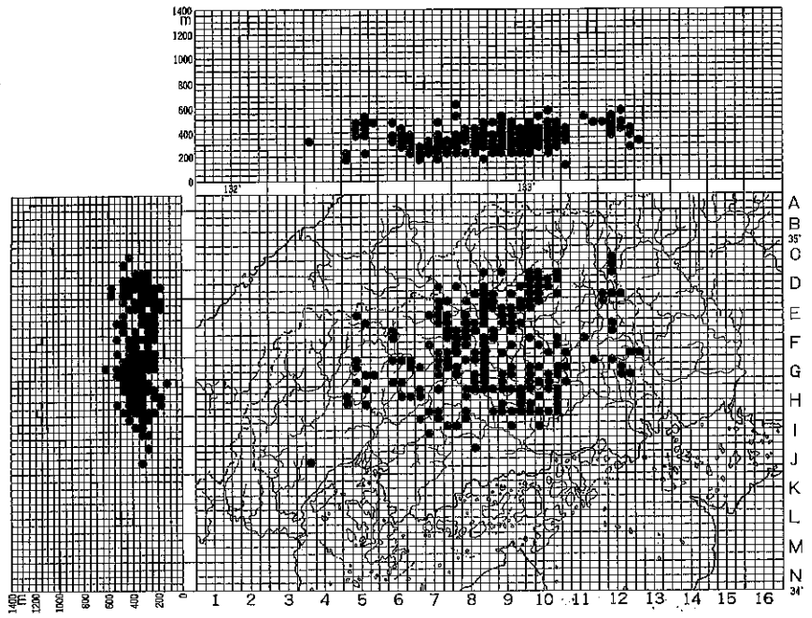

Fig. 21. A map showing the distribution of the *Querco myrsinaefoliae-Pinetum densiflorae acanthopanacetosum sciadophylloidis.*

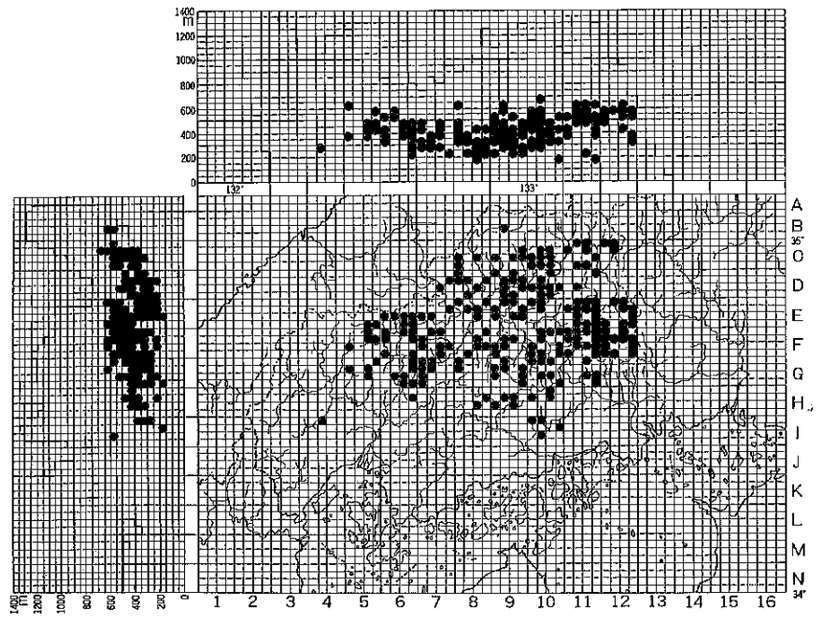

Fig. 22. A map showing the distribution of the *Querco myrsinaefoliae-Pinetum densiflorae vaccinetosum japonicum.*

Pinus densiflora, +.1 *Cymbidium goeringii*, +.1 *Pteridium aquilinum* var. *latiusculum*, +.1 *Ampelopsis brevipedunculata*, +.1 *Cornus kousa*, +.1 *Pourthiaea villosa* var. *laevis*, +.1 *Schisandra repanda.*

Moss layer: 7%. 1.2 *Dicranum scoparium*, +.1 *Brotherella henonii.*

III. Alliance: *Querco-Pinion densiflorae* Suzuki et Toyohara 1971

In the system of Japanese pine forests by Toyohara (1973), the following species were determined as character or differential species of this alliance: *Quercus mongolica* var. *grosseserrata*, *Sorbus alnifolia*, *Acer mono*, *Kalopanax pictus*, *Magnolia obovata*, *Spodiopogon sibiricus*, *Atractyloides japonica*, *Disporum smilacinum* and *Prunus grayana.* In the present study, this is characterized by the species groups 23 and 24 as shown in Table 3. This alliance is composed of secondary forest communities developing in both the cool-temperate zone and upper part of the mixed-temperate zone. The tree layer is dominated by *Pinus densiflora*, *Quercus serrata* and *Q. mongolica* var. *grosseserrata.* Both the subtree and the shrub layers are dominated by many deciduous broad-leaved trees, sometimes comprising evergreen broad-leaved trees. The herb layer is usually covered with species of *Sasa.*

Communities of this alliance are floristically similar to the deciduous broad-leaved secondary forests, but they are distinguished from the latter by having the species group 27 representing the character or differential species of the order *Pinetalia densiflorae.* It is assumed that climax forests such as the deciduous broad-leaved forest (*Fagus crenata* forest) and the intermediate conifer forest (*Tsuga sieboldii* forest) have changed into the deciduous broad-leaved secondary forest (*Quercus mongolica* var. *grosseserrata* or *Q. serrata* forest) as a result of repeated cutting, and furthermore, turned into the pine or oak secondary forest belonging to this alliance through strong exploitation. In another words, this alliance is composed of secondary forests of the degradated type of secondary succession. It is presumed that the strong exploitation may have caused the inversion of ericaceous plants and *Pinus densiflora* into the deciduous broad-leaved secondary forests.

III–1. *Association*: Tsugio sieboldii-Pinetum densiflorae (*Yoshioka 1958*)

Character or differential species: *Tsuga sieboldii*, *Quercus salicina*, *Ardisia japonica.*

This is the secondary forest developing in the mixed-temperate zone. The original natural forest is presumed to be the intermediate conifer forest such as the *Tsuga sieboldii* forest accompanied by *Quercus salicina.* In the present time, however, the tree species mentioned above are frequently not seen. This is found in the inland area, and the vertical range of its stands lies in about 400–800 m (Fig. 23).

Type record: St. no. Osorakan-68, Nasu, Togouchi-cho, Yamagata-gun, Hiroshima Prefecture, 30 July, 1975. Altitude: 700 m; slope aspect: S70°W; slope degree: 35°; microtopography: ridge; mother rock: granite.

Tree layer: 17 m, 95%; DBH of the largest tree: 30 cm. 3.3 *Quercus serrata*, 2.2 *Q. mongorica* var. *grosseserrata*, 2.2 *Pinus densiflora*, 2.2 *Carpinus laxiflora*, 1.1 *Fagus japonica*, 1.1 *Castanea crenata*, 1.1 *Tsuga sieboldii*, 1.1 *Sorbus japonica.*

Subtree layer: 10 m, 80%. 4.4 *Ilex pedunculosa*, +.1 *I. macropoda*, 2.2 *Tsuga sieboldii*, 2.2 *Pieris japonica*, 2.2 *Clethra barbinervis*, 1.2 *Lyonia ovalifolia* var. *elliptica*, 1.1 *Rhus trichocarpa*, 1.1 *Fagus japonica*, 1.1 *Acer sieboldianum*, 1.1 *Magnolia salicifolia*, 1.1 *Stewartia pseudo-camellia*, 1.1 *Quercus*

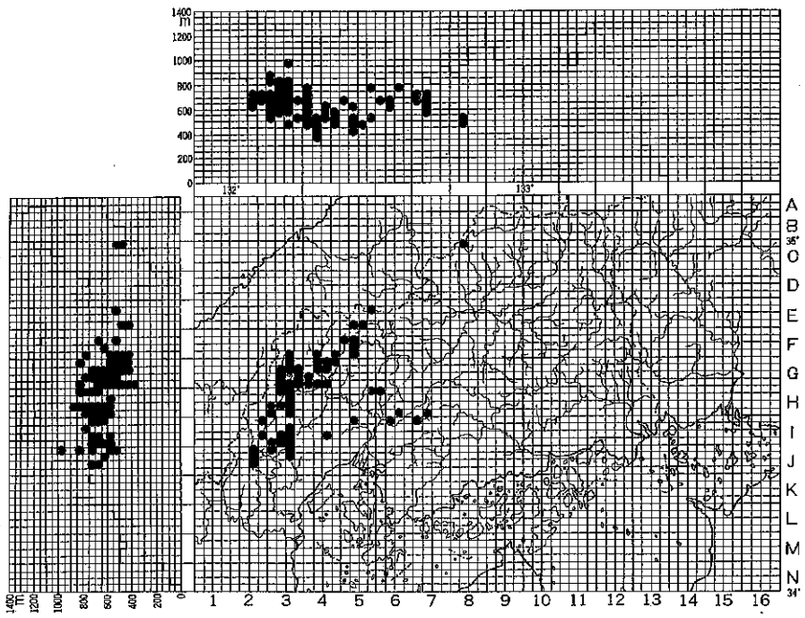

Fig. 23. A map showing the distribution of the *Tsugio sieboldii-Pinetum densiflorae.*

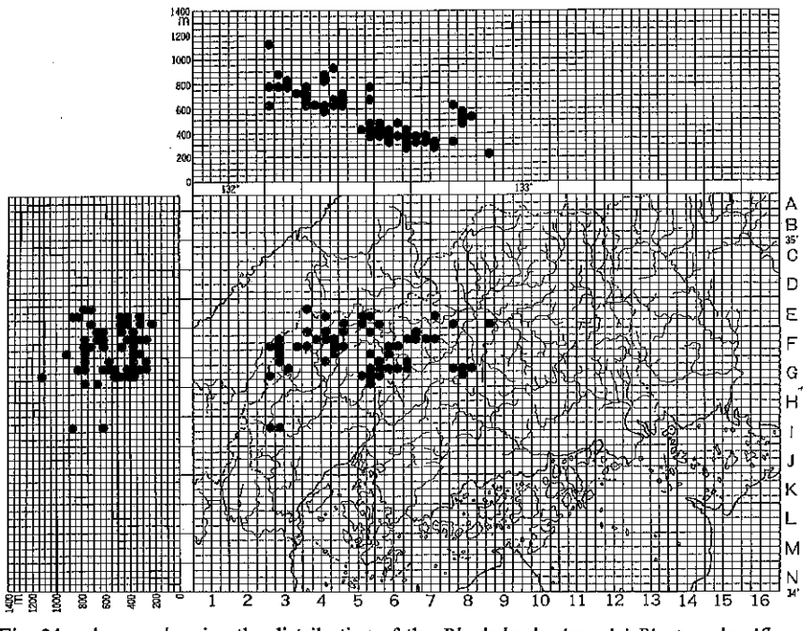

Fig. 24. A map showing the distribution of the *Rhododendro japonici-Pinetum densiflorae.*

mongolica var. *grosseserrata*, +.1 *Meliosma myriantha.*

Shrub layer: 4 m, 40%. 2.2 *Tsuga sieboldii*, 2.2 *Pieris japonica*, 2.2 *Rhododendron reticulatum*, +.1 *R. semibarbatum*, 1.2 *Quercus salicina*, 1.2 *Eurya japonica*, 1.2 *Viburnum wrightii*, +.1 *Chamaecyparis obtusa*, +.1 *Amelanchier asiatica*, +.1 *Lyonia ovalifolia* var. *elliptica*, +.1 *Stewartia pseudo-camellia*, +.1 *Ilex macropoda*, +.1 *Prunus verecunda*, +.1 *Magnolia salicifolia*, +.1 *Vaccinium smallii* var. *glabrum*, +.1 *Menziesia ciliicalyx*, +.1 *Daphniphyllum macropodum* var. *humile*, +.1 *Ilex pedunculosa.*

Herb layer: 0.5 m, 10%. 2.2 *Shortia soldanelloides* var. *magna*, +.2 *Skimia japonica*, +.2 *Ardisia japonica*, +.2 *Mitchella undulata*, +.2 *Disporum smilacinum*, +.2 *Quercus salicina*, +.1 *Tsuga sieboldii*, +.1 *Abies firma*, +.1 *Ilex crenata*, +.1 *Smilax china*, +.1 *Pieris japonica*, +.1 *Vaccinum japonicum*, +.1 *Rhus trichocarpa*, +.1 *Hydrangea hirta*, +.1 *Struthiopteris niponica*, +.1 *Fraxinus lanuginosa*, +.1 *Acer crataegifolium*, +.1 *Styrax obassia*, +.1 *Platanthera minor.*

Moss layer: +. +.2 *Leucobryum neilgherrense.*

III–2. *Association*: Rhododendro japonici-Pinetum densiflorae, *ass. nov.*

Character or differential species: *Rhododendron japonicum, Vaccinium ciliatum.*

This association develops mainly on humid or wet sites consisting of "Kuroboku" soil ("Ando" soil) derived from the volcanic ash. Both the shrub and herb layers are so frequently cut off for fuel or a vegetation manure heap that many sun plants such as components of the grassland invade into the forest floor. The distribution of this community is shown in Fig. 24.

Type record: St. no. 641, Hosomi, Geihoku-cho, Yamagata-gun, Hiroshima Prefecture, 18 Aug., 1974. Altitude: 620 m; slope aspect: N50°E; slope degree: 10°; microtopography: middle part of slope; mother rock: rhyolite.

Tree layer: 20 m, 90%; DBH of the largest tree: 40 cm. 5.5 *Pinus densiflora*, 1.1 *Quercus variabilis.*

Subtree and shrub layers: cut off.

Herb layer: 0.8 m, 100%. 3.4 *Miscanthus sinensis*, 3.4 *Ilex crenata*, 2.2 *Castanea crenata*, 2.2 *Sasa palmata*, 2.2 *Arundinella hirta*, 2.2 *Arundinaria pygmaea* var. *glabra*, 2.2 *Quercus dentata*, 1.2 *Q. serrata*, 2.2 *Rhododendron reticulatum*, 1.2 *R. lagopus*, 1.2 *R. japonicum*, 1.2 *R. kaempferi*, 1.2 *Vaccinium ciliatum*, +.1 *V. japonicum*, +.1 *V. oldhamii*, 1.2 *Rhus trichocarpa*, 1.2 *Abelia serrata*, 1.2 *Struthiopteris niponica*, 1.2 *Smilax china*, 1.2 *Corylus heterophylla* var. *thunbergii*, 1.2 *Dioscorea gracillima*, +.1 *Viburnum wrightii*, +.1 *V. erosum*, +.1 *Pinus densiflora*, +.1 *Pieris japonica*, +.1 *Ilex pedunculosa*, +.1 *I. serrata*, +.1 *Prunus jamasakura*, +.1 *Amelanchier asiatica*, +.1 *Cornus kousa*, +.1 *Lyonia ovalifolia* var. *elliptica*, +.1 *Pteridium aquilinum* var. *latiusculum*, +.1 *Solidago virga-aurea* var. *asiatica*, +.1 *Rosa multiflora*, +.1 *Atractilodes japonica*, +.1 *Disporum smilacinum*, +.1 *Lespedeza bicolor*, +.1 *Sorbus alnifolia*, +.1 *Ixeris dentata*, +.1 *Lilium japonicum*, +.1 *Patrinia scabiosaefolia*, +.1 *Aster scaber*, +.1 *Gentiana scabra* var. *buergeri*, +.1 *Polygala japonica*, +.1 *Veratrum maackii* var. *maackii*, +.1 *Saussurea gracillis*, +.1 *Sanguisorba officinalis.*

III–3. *Association*: Querco grosseserratae-Pinetum densiflorae (*Yoshioka 1958*)

Synonym: *Pinus densiflora–Quercus serrata* association, Yoshioka 1958. *Castaneto-Quercetum crispurae*, Horikawa & Sasaki 1959, p.p.

This association is recognized by lacking peculaiar character or differential species for the association, and is characterized by only the character or differential species of the alliance. It is most common in the secondary forests in both the mixed-temperate and the cool-temperate zones. The distribution of this association is shown in Fig. 25.

Type record: St. no. 667, Geihoku-cho, Yamagata-gun, Hiroshima Prefecture, 6 Sep., 1974.

Altitude: 820 m; slope aspect: S60°E; slope degree: 15°; microtopography: ridge; mother rock: granite.

Tree layer: 20 m, 90%; DBH of the largest tree: 40 cm. *5.5 Pinus densiflora*, 1.1 *Quercus mongolica* var. *grosseserrata*.

Subtree layer: 7 m, 40%. 3.4 *Clethra barbinervis*, 2.2 *Quercus mongolica* var. *grosseserrata*, 1.1 *Q. serrata*, 1.1 *Sorbus japonica*, +.1 *Cornus kousa*, +.1 *Castanea crenata*, (+.1) *Acanthopanax sciadophylloides*.

Shrub layer: 2 m, 60%. 3.4 *Rhododendron lagopus*, 2.2 *Clethra barbinervis*, 2.2 *Symplocos coreana* 1.2 *Viburnum wrightii*, +.1 *Hydrangea hirta*, +.1 *Rhus trichocarpa*, +.1 *Quercus serrata*, +.1 *Cornus kousa*, +.1 *Vaccinium smallii* var. *glabrum*, +.1 *V. oldhamii*, +.1 *Viburnum erosum*, +.1 *Corylus sieboldiana*, (+.1) *Eurya japonica*.

Herb layer: 0.7 m, 5%. +.2 *Sasa veitchii* var. *hirta* (seedlings), +.2 *Vaccinium japonicum*, +.2 *Rhododendron lagopus*, +.1 *R. kaempferi*, +.2 *Ilex crenata*, +.1 *Smilax china*, +.1 *Hydrangea hirta*, +.1 *Viburnum wrightii*, +.1 *Lindera umbellata*, +.1 *Castanea crenata*, +.1 *Quercus mongolica* var. *grosseserrata*, +.1 *Dioscorea gracillima*, +.1 *Cephalotaxus harringtonia* var. *nana*, +.1 *Styrax japonica*, +.1 *Struthiopteris niponica*, +.1 *Rhus trichocarpa*, +.1, *R. ambigua*, +.1 *Prunus grayana*, +.1 *Smilax nipponica*, +.1 *Acanthopanax sciadophylloides*, +.1 *Pteridium aquilinum* var. *latiusculum*, +.1 *Pourthiaea villosa* var. *laevis*, +.1 *Platanthera minor*.

Deciduous broad-leaved secondary forests belonging to other orders

IV. *Association*: Castaneo-Quercetum crispurae *Horikawa et Sasaki 1959*

This was originally described by Horiakawa and Sasaki (1959) from the Sandankyo Gorge and Yawata highlands in Hiroshima Prefecture. They mentioned that the association was composed of secondary forests respectively of *Quercus mongolica* var. *grosseserrata*, *Q. serrata*, *Pinus densiflora* and of *Fagus japonica*. In the present treatment, however, the identification with this association is restricted to *Quercus mongolica* var. *grosseserrata*- and *Fagus japonica* secondary forests which are distingusihed from the *Querco-Pininon densiflorae* by lacking the character or differential species of the *Pinetalia densiflorae* such as the species group 27 in Table 3. *Quercus serrata*- and *Pinus densiflora* secondary forests having the species group 27 are here excluded from this association.

This association is subdivided into two communities developing in different altitudinal zones.

IV–I. *Quercus mongolica* var. *grosseserrata–Castanea crenata* community

This is recognized by having the species group 25 as shown in Table 3. According to Toyohara (1977), the vertical range of this forest on the Hiba mountains situated in the northeastern part of Hiroshima Prefecture, covers the slope at altitudes of 700–960 m.

IV–2. *Quercus mongolica* var. *grosseserrata–Fagus crenata* community

This is the secondary forest developing on highlands, occupying the region higher than 960 m above sea-level (Toyohara 1977).

V. *Quercus variabilis* community

This is found in both the warm-temperate zone and the lower part of the mixed-temperate zone. It is developed significantly on sites of the Palaeozoic formations or

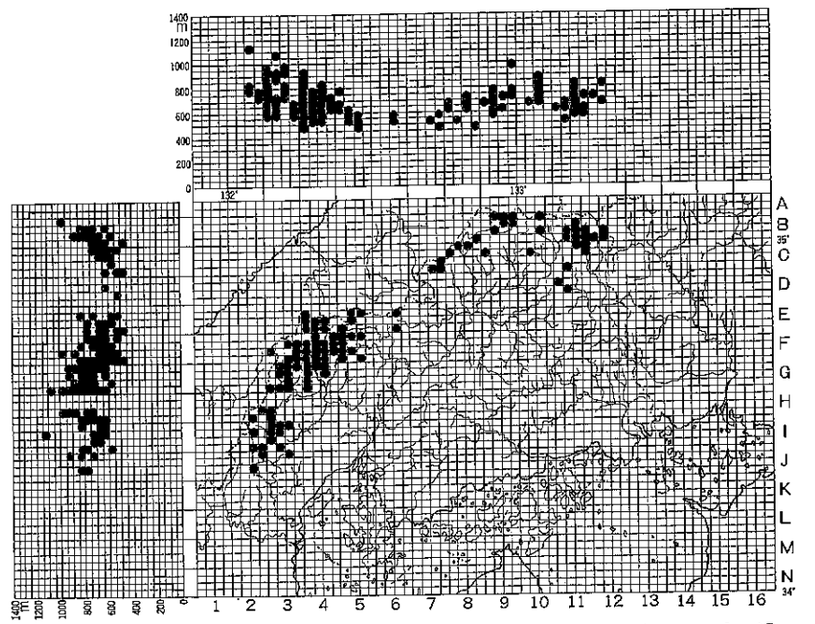

Fig. 25. A map showing the distribution of the *Querco grosseserratae-Pinetum densiflorae*.

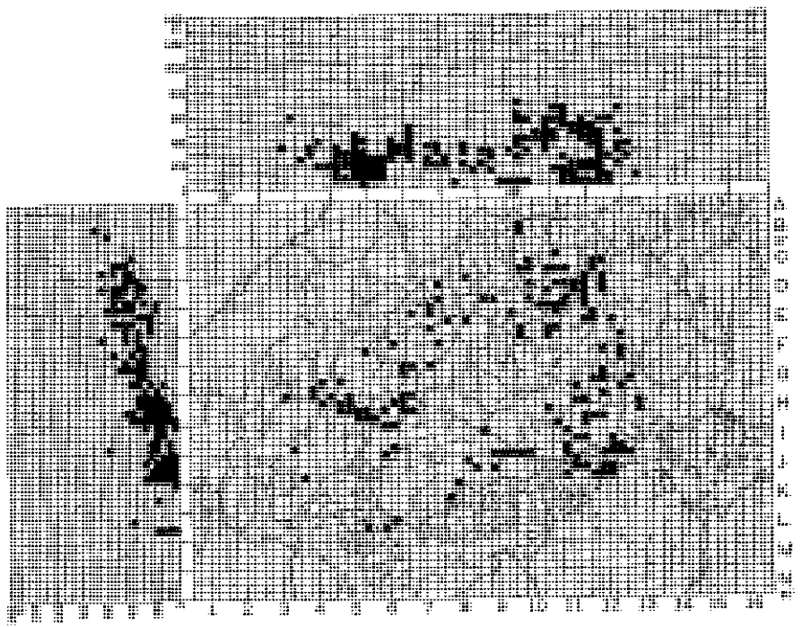

Fig. 26. A map showing the distribution of the *Quercus variabilis* community.

andesite (Figs. 8, 9 and 26). The tree layer is usually dominated by *Quercus variabilis* or *Q. serrata* and sometimes by *Pinus densiflora*. The subtree layer is dominated by evergreen broad-leaved tree such as *Quercus glauca* and *Q. myrsinaefolia*. This community is characterized by the species group 29 in Table 3.

A Tentative Draft on Vegetation Mapping of the Secondary Forests in Hiroshima Prefecture

Based on the result of the study on the vertical and horizontal distribution of vegetation units of the secondary forest, the author has laid out a plan of vegetation mapping. An actual vegetation map of Hiroshima Prefecture at a scale of 1: 200,000, defined by associations, may be prepared for the secondary forests by the following process.

1. Physiognomical vegetation maps defined by the growth form of dominant species at a scale of 1: 50,000 or 1: 25,000 are made by interpretation of aerophotographs, supplemented by observations of the vegetation in the field. In these maps, secondary forests may be divided into two divisions, i.e., the evergreen pine forest and the deciduous broad-leaved secondary forest. (The evegreen broad-leaved secondary forest is very rare). From these physiognomical maps, phytosociological vegetation maps are produced by the following procedure.

2. Secondary forests are divided into altitudinal divisions by the contour lines of 400, 700, and 950 m. The upper division above 950 m corresponds nearly to the *Quercus mongolica* var. *grosseserrata–Fagus crenata* community (IV–2) belonging to the deciduous broad-leaved secondary forest of the cool-temperate zone. A detailed discussion about the boundary was made by Toyohara (1977).

The deciduous broad-leaved secondary forest developing between the contour lines of 700 and 950 m corresponds to the *Quercus mongolica* var. *grosseserrata–Castanea crenata* community (IV–1). In this division, stands belonging to the *Pinetalia densiflorae* frequently intervene, but it is difficult to separate them from the communities of this division only by the physiognomy; they must be investigated by field surveys.

The pine forest developing in areas higher than 700 m corresponds to the alliance *Querco-Pinion densiflorae* (III) belonging to the *Pinetalia densiflorae*, though stands belonging to this alliance are occasionally seen in areas lower than 700 m (Fig. 27). The mixed pine-oak secondary forest is also identified with the community of this division.

Both the pine and the deciduous broad-leaved secondary forests developing in areas between 400 and 700 m are treated as a division corresponding to the *Querco salicinae-Pinetum densiflorae* (II–4, Fig. 28), though they are occasionally mixed with the *Tsugio sieboldii-Pinetum densiflorae* (III–1) or the *Querco myrsinaefoliae-Pinetum densiflorae* (II–5).

3. Secondary forests of lowlands below 400 m are divided into three divisions which are found in horizontally represented areas.

The first is the *Symploco-Pinetum densiflorae* (II–1), which is found restricted to Miyajima Island.

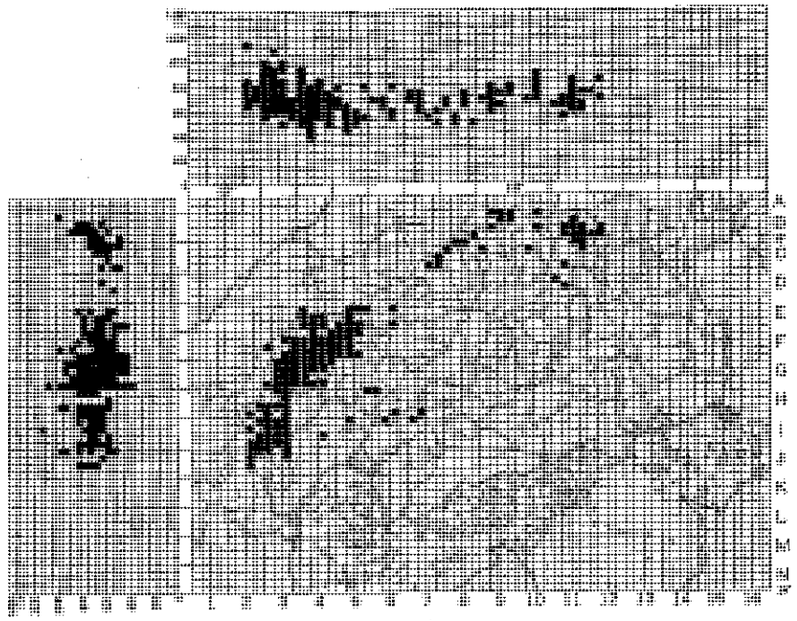

Fig. 27. A map showing the distribution of the stands belonging to the alliance *Querco-Pinion densiflorae*.

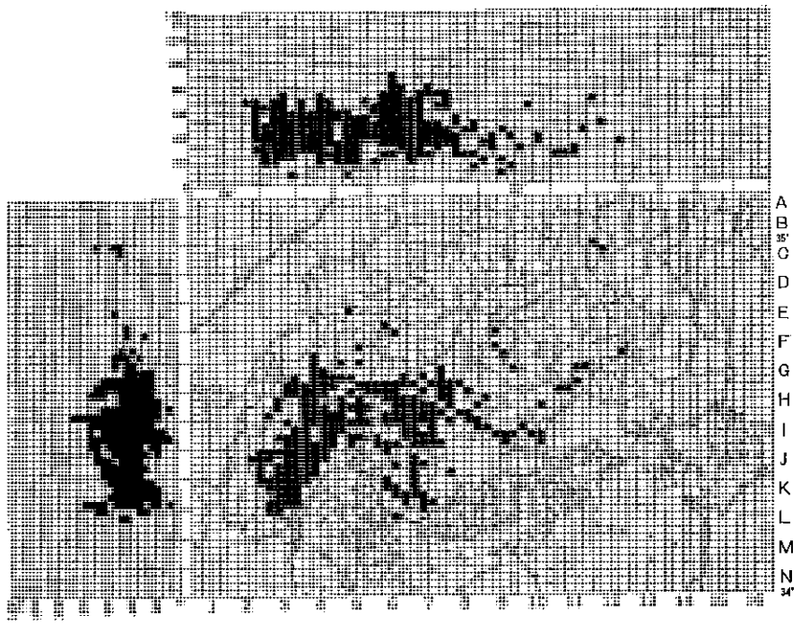

Fig. 28. A map showing the distribution of the *Querco salicinae-Pinetum densiflorae*.

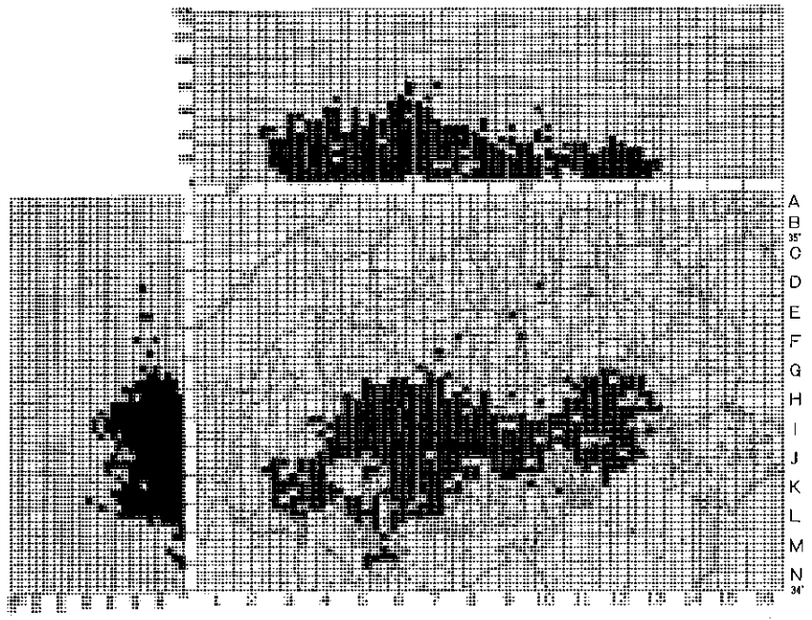

Fig. 29. A map showing the distribution of the stands comprising at least one of *Dicranopteris linearis*, *Vaccinium bracteatum*, *Symplocos lucida* and *Ilex chinensis*.

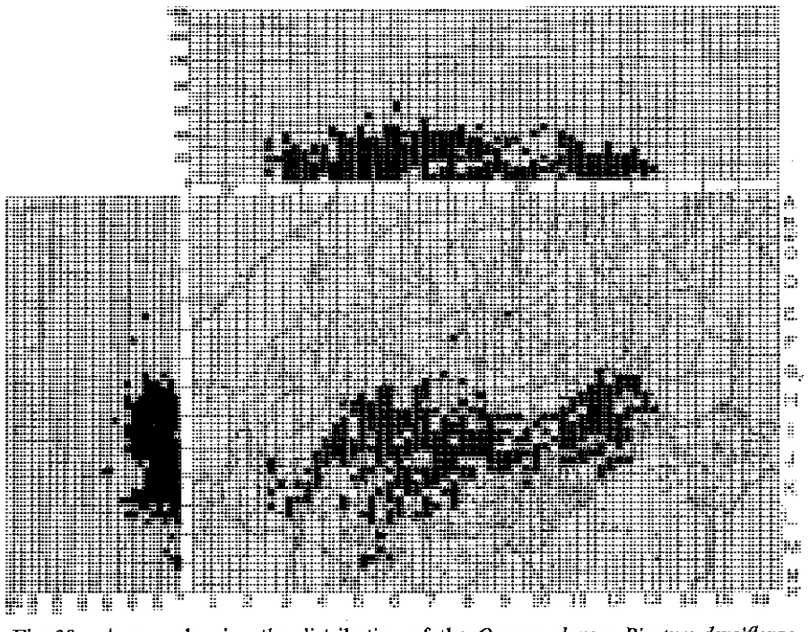

Fig. 30. A map showing the distribution of the *Querco glaucae-Pinetum densiflorae*.

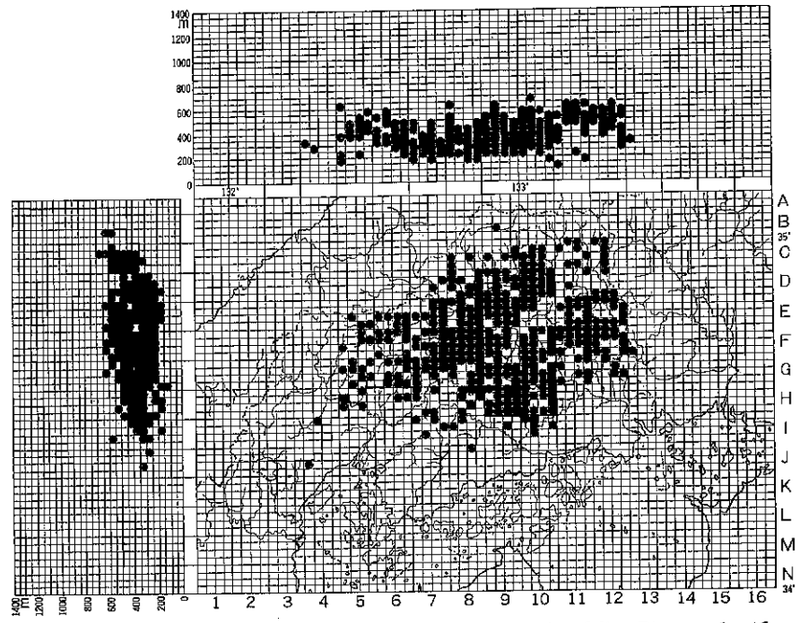

Fig. 31. A map showing the distribution of the *Querco myrsinaefoliae-Pinetum densiflorae*.

The second is the *Querco glaucae-Pinetum densiflorae* (II–3), which is recognized within the horizontal distribution range of its four important components: *Dicranopteris linearis*, *Vaccinium bracteatum*, *Symplocos lucida* and *Ilex chinensis* (Fig. 29). The horizontal distribution boundary of the *Querco glaucae-Pinetum densiflorae* (Fig. 30) corresponds nearly to that of the above four species, but they are not parallel with each other in their vertical distribution. A detailed discussion about the boundary line was made by Toyohara (1981).

The third is the *Querco myrsinaefoliae-Pinetum densiflorae* (II–5), which is developed outside of the horizontal distribution range of the above-mentioned four species (Fig. 31).

4. Occurrence of the *Quercus variabilis* community (V) is recognized by the help of the geological map, namely, the deciduous broad-leaved secondary forest developing on Palaeozoic formations or andesite in areas lower than 700 m may be referred to this community.

5. An actual vegetation map defined by associations at a scale of 1: 200,000 is reproduced from the vegetation maps at a scale of 1: 50,000 or 1: 25,000.

6. The actual vegetation map finally produced through the above-mentioned procedure should be further checked and corrected by field survays.

A Detailed Classification of Pine Forest Suffering Frequent Fires in the Coastal Region

The pine forests in the coastal region have been influenced by frequent fires, and

some have already been changed into degradated communities in the course of secondary succession. The author believes that a phytosociological study of the pine forests should be made in due consideration of the succession, fire, cutting and other forest managements. Suzuki and Toyohara (1971) and Toyohara (1978) studied pine forests in the inland areas of Hiroshima Prefecture from the view point of succession following cutting or other forest management. In this chapter, the succession of the pine forests in the coastal region is discussed in relation to fires.

A phytosociological classification of the pine forests including stands influenced by fire or cutting is shown below and its structural summary is in Table 4. In this classification, the system of enumeration numbers is different from that previously employed for the order *Pinetalia densiflorae*.

I. *Cladio aggregatae-Pinetum densiflorae*
II. *Querco phillyraeoidis-Pinetum densiflorae*
III. *Querco glaucae-Pinetum densiflorae*
III–1. *Juniperetosum rigidae*
1–A. Typical variant
1–A–a. Typical subvariant
1–A–a–i. *Juniperus rigida* group
1–A–a–ii. *Arundinella hirta* group (1. Typical subgroup. 2. *Rhus javanica* subgroup. 3. *Erechtites hieracifolia* subgroup)
1–A–b. *Symplocos lucida* subvariant
1–A–b–i. *Juniperus rigida* group (1. Typical subgroup. 2. *Rhus javanica* subgroup)
1–A–b–ii. *Arundinella hirta* group
1–B. *Ardisia japonica* variant (1. Typical subgroup. 2. *Rhus javanica* subgroup)
III–2. *Dicranopteridetosum linearis*
2–A. Typical variant
2–A–a. Typical subvariant
2–A–a–i. *Juniperus rigida* group
2–A–a–ii. *Arundinella hirta* group (1. Typical subgroup. 2. *Rhus javanica* subgroup. 3. *Erechtites hieracifolia* subgroup. 4. *Polygala japonica* subgroup)
2–A–b. *Symplocos lucida* subvariant
2–A–b–i. *Juniperus rigida* group (1. Typical subgroup. 2. *Rhus javanica* subgroup)
2–A–b–ii. *Arundinella hirta* group (1. Typical subgroup. 2. *Rhus javanica* subgroup. 3. *Erechtites hieracifolia* subgroup. 4. *Polygala japonica* subgroup)
2–B. *Ardisia japonica* variant
2–B–a. Typical subvariant
2–B–a–i. *Juniperus rigida* group (1. Typical subgroup. 2. *Rhus javanica* subgroup)
2–B–a–ii. *Arundinella hirta* group (1. *Rhus javanica* subgroup. 2. *Erechtites hieracifolia* subgroup)
2–B–b. *Ardisia crenata* subvariant

2–B–b–i. *Juniperus rigida* group (1. Typical subgroup. 2. *Rhus javanica* subgroup)
2–B–b–ii. *Arundinella hirta* group
IV. *Castanopsis cuspidata–Pasania glabra* community
IV–1. *Pinus densiflora* group
IV–2. Typical group

The degradation of forest communities is generally suggested by the disappearance of plants composing the climatic climax forest such as evergreen broad-leaved trees, and by invasion of plants composing grassland or mantle community.

The degradation or progression of the secondary succession can be illustrated by the change of species composition (Fig. 32). In Fig. 32, each community may maintain the stable species composition balanced with the fire impact under every existing condition. It is presumed that when the fire impact is strong, the degradation of secondary succession occurs, and inversely, when it is weak, the progression of secondary succession may be induced. This change may be related to frequency and intensity of fire. Furthermore, the influence of the fire is immediately proved by the disappearance

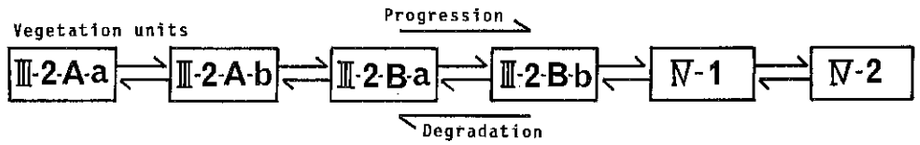

Fig. 32. Schematic diagram showing the succession of the pine forests belonging to the *Querco glaucae-Pinetum densiflorae dicranopteridetosum linearis*, at the coastal areas in Hiroshima Prefecture. Each successional stage is assumed by the species composition of the communities. III–2, *Querco glaucae-Pinetum densiflorae dicranopteridetosum linearis*: III–2–A–a, typical variant, typical subvariant; III–2–A–b, typical variant, *Symplocos lucida* subvariant; III–2–B–a, *Ardisia japonica* variant, typical subvariant; III–2–B–b, *Ardisia japonica* variant, *Ardisia crenata* subvariant. IV, *Castanopsis cuspidata–Pasania glabra* community (IV–1, *Pinus densiflora* group; IV–2, typical group).

of *Juniperus rigida*, by the occurrence of *Arundinella hirta* and *Lespedeza cyrtobotrya* which are main components of the grassland, by the invasion of certain shrub species such as *Zanthoxylum schinifolium*, *Rhus javanica*, *Mallotus japonicus* and *Aralia elata* (species group 11 in Table 4), and by the growth of such exotic plants as *Erigeron* spp. and *Erechtites hieracifolia* (species group 13 in Table 4) which are usually found in disturbed forests.

Such a change is often caused by a fire. The above-mentioned plants characteristic to burned sites disappear by the regeneration of pine forests after several years, but *Juniperus rigida* grows up further (Fig. 33).

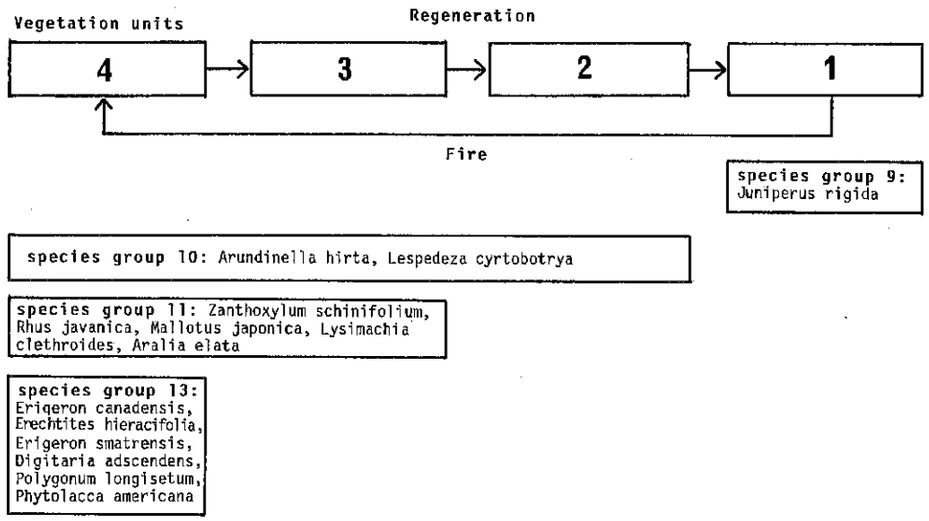

Fig. 33. Schematic diagram showing the natural regeneration of pine forests after the fire. Each phase of the regeneration is assumed by the species composition of communities. 1, *Juniperus rigida* group of each vegetational unit. 2, typical subgroup of the *Arundinella hirta* group. 3, *Rhus javanica* subgroup of the *Arundinella hirta* group. 4, *Erechtites hieracifolia* subgroup of the *Arundinella hirta* group.

As a sample of the spatial arrangement of the vegetation units, a map at a scale of 1: 2,500 was made in Oono-cho by field surveys (Fig. 34). It seems that the forests developed around the ridges are usually changed into degradated communities, and inversely, in the lower part of slopes the communities are usually progressive. The productivity of the sites may also be estimated from this map.

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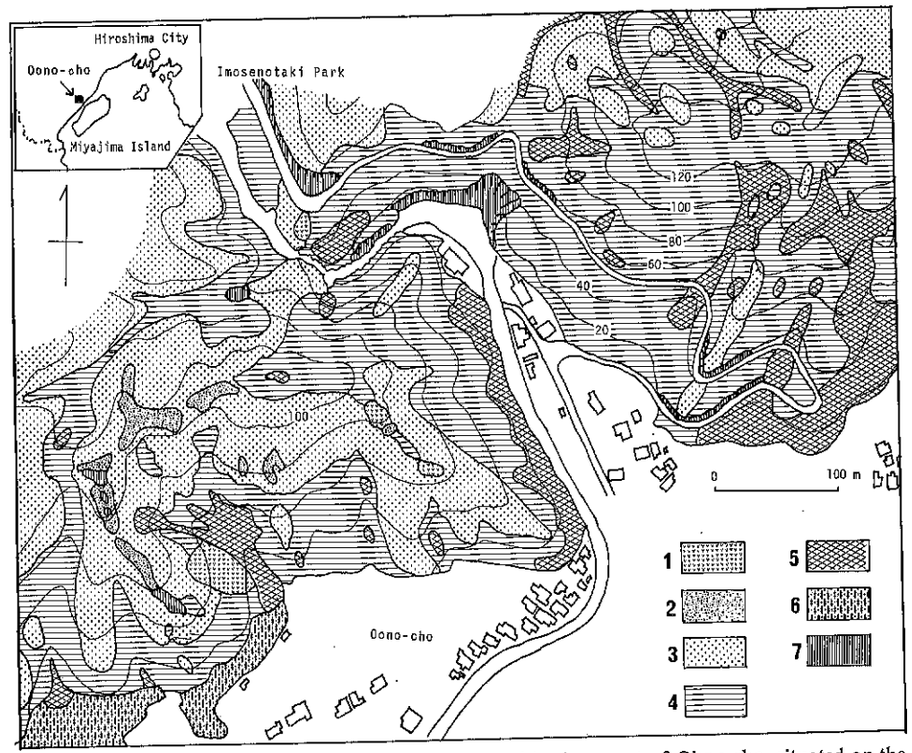

Fig. 34. A detailed vegetation map of forest communities in a part of Ohno-cho, situated on the southwestern coast of Hiroshima Prefecture. 1, *Querco glaucae-Pinetum densiflorae juniperetosum rigidae*, typical variant. 2, *Cladio aggregatae-Pinetum densiflorae dicranopteridetosum linearis*. 3, *Querco glaucae-Pinetum densiflorae dicranopteridetosum linearis*, typical variant, typical subvariant. 4, *Querco glaucae-Pinetum densiflorae dicranopteridetosum linearis*, typical variant, *Symplocos lucida* subvariant. 5, *Querco glaucae-Pinetum densiflorae dicranopteridetosum linearis*, *Ardisia japonica* variant. 6, bamboo forest. 7, naked land.

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Table 3. Synthesis table of pine forest communities and their neighboring communities in Hiroshima Prefecture

ler : Pinetalia densiflorae Suz.-Tok. 1966
. Alliance : Cladonio-Pinion densiflorae Toyohara 1979
I-1. Ass. : Cladio-aggregatae-Pinetum densiflorae, ass. nov.
I-1-A. Subass. : Juniperetosum rigidae
I-1-B. Subass. : Dicranopteridetosum linearis
I-1-C. : Acanthopanacetosum sciadophylloidis
I-2. Ass. : Davallio-Pinetum densiflorae Toyohara 1979
I-2-A. Subass. : Quercetosum glaucae
I-2-B. Subass. : Quercetosum grosseserratae
I. Alliance : Cyclobalanopsio-Pinion densiflorae Suzuki et Toyohara 1971
II-1. Ass. : Symploco-Pinetum densiflorae Toyohara et Suzuki 1975
II-1-A. Subass. : Myrsinetosum seguinii
II-1-B. Myrsine seguinii-Quercus acuta transitional comm.
II-1-C. Subass. : Quercetosum acutae
II-2. Ass. : Querco phillyraeoidis-Pinetum densiflorae, ass. nov.
II-3. Ass. : Querco glaucae-Pinetum densiflorae (Yoshioka 1958)
II-3-A. Subass. : Juniperetosum rigidae
II-3-B. Subass. : Dicranopteridetosum linearis
II-3-C. Subass. : Evodiopanacetosum innovans
II-4. Ass. : Querco salicinae-Pinetum densiflorae, ass. nov.
II-4-A. Subass. : Dicranopteridetosum linearis
II-4-B. Subass. : Hydrangetosum luteo-venosae
II-5. Ass. : Querco myrsinaefoliae-Pinetum densiflorae, ass. nov.
II-5-A. Subass. : Acanthopanacetosum sciadophylloidis
II-5-B. Subass. : Vaccinetosum japonicus
III. Alliance : Querco-Pinion densiflorae Suzuki et Toyohara 1971
III-1. Ass. : Tsugio sieboldii-Pinetum densiflorae (Yoshioka 1958)
III-2. Ass. : Rhododendro japonicum-Pinetum densiflorae, ass. nov.
III-3. Ass. : Querco grosseserratae-Pinetum densiflorae, ass. nov.
Deciduous broad-leaved secondary forests belonging to other orders
IV. Ass. : Castanoto-Quercetum crispulae Horikawa et Sasaki 1959
IV-1. Quercus mongolica var. grosseserrata-Castanea crenata community
IV-2. Quercus mongolica var. grosseserrata-Fagus crenata community
V. Quercus variabilis community
V-1. Quercus variabilis-Quercus glauca subordinate community
V-2. Quercus variabilis-Quercus myrsinaefolia subordinate community
Climatic climax community in warm-temperate regions
VI. Evegreen broad-leaved forest : Castanopsis cuspidata-Pasania glabra comm.
Climatic climax community in cool-temperate regions
VII. Deciduous broad-leaved forest : Lindero umbellatae-Fagetum crenatae (Sasaki 1964) Sasaki 1970

Vegetation units	I					II										III			IV		V			VI	VII
	1			2		1			2	3			4		5		1	2	3	1	2	1		2		
	A	B	C	A	B	A	B	C		A	B	C	A	B	A	B										
Number of records	18	33	28	18	19	313	24	60	21	48	140	97	85	68	197	56	23	30	97	17	31	24	41	22	21	11
Arundinella hirta	IV+-2	IV+-2	III+-2	.	.	.	.	.	II+-1	I+-3	I+-1	.	r+-1	r +	r+-3	r +	.	I+-2	.	.	.	.	.	.	.	.
Haloragis micrantha	I +	II+-1	II+-1	.	.	.	.	.	.	.	.	.	.	.	r +	r +	.	.	.	.	.	.	.	.	.	.
Polygara japonica	.	II+-1	II+-1	.	.	.	.	.	r +	I+-1	r +	.	r +	r +	r +	.	.	r +	.	.	.	.	.	.	.	.
Davallia mariesii	.	.	.	III+-1	III+-1	r +	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhododendron mucronulatum var. ciliatum	I 2	r 1	.	III+-3	IV+-3	.	.	.	I+-2	.	r +	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lepisorus thunbergianus	I +	r +	.	II +	II +	.	r +	r +	I +	II +	r +	r +	r +	.	r +	.	.	.	.	.	.	II +	I +	I +	I +	.
Bulbophyllum drymoglossum	.	.	.	II+-1	I +	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dendrobium moniliforme	.	.	.	II+-1	II +	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tripetaleia paniculata	.	.	.	III+-1	III+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+-1	.	.	.	.	.	.
Sorbus gracilis	.	.	.	III+-1	V+-2	.	.	.	.	.	.	.	.	r +	.	.	.	r +	.	I +	.	.	.	.	.	.
Mecodium polyanthos	.	.	.	III+-1	II+-3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Enkianthus cernuus f. rubens	.	.	.	II+-1	III+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	I+-2	.	.	.	.	.	.	I+-2
Hymenophyllum barbatum	.	.	.	II+-2	II+-2	.	.	r +	.	.	.	.	.	.	.	.	r +	.	.	.	.	.	.	.	.	.
Cladonia rangiferina	IV+-3	V+-3	V+-4	V+-3	V+-2	.	.	.	.	.	.	.	.	.	r +	r +	.	.	.	.	.	.	.	.	.	.
Cladia aggregata	V+-3	V+-3	V+-3	III+-2	I +	.	.	.	.	.	r +	.	.	.	r +	.	.	.	.	.	.	.	.	.	.	.
Rhacomitrium canescens	III+-1	II+-1	I +	III+-1	II+-2	.	.	.	I +	r 1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Campylopus richardii	III+-2	II+-1	III+-1	II +	I +	.	.	.	II +	r 1	r +	.	.	.	r +	.	.	.	.	.	.	.	.	.	.	.
Wikstroemia sikokiana	I +	II+-1	II+-1	IV+-1	III+-1	I+-2	I +	I +	I+-1	.	I+-1	I+-1	I+-2	I+-1	.	r +	r +	.	.	.	.	.	.	.	.	.
Melampyrum laxum var. nikkoense	.	II+-1	I+-1	IV+-1	III+-1	I+-2	.	I +	.	.	r +	.	I +	I+-2	r +	I +	I +	I+-1	I +	I+-2	r +	.	.	.	.	.
Symplocos prunifolia	.	.	.	.	.	III+-5	V+-3	IV+-5	.	r +	r+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Neolitsea aciculata	.	.	.	.	.	III+-5	IV+-1	IV+-3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Diospyros morrisiana	.	.	.	.	.	II+-3	III+-2	II+-2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Myrsine seguinii	.	.	.	.	.	IV+-5	V+-3	I +	.	r +	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Symplocos glauca	.	.	.	.	.	II+-4	II+-4	I+-3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Quercus(Cyclobalanopsis) salicina	.	.	.	III+-1	IV+-2	.	II+-3	IV+-5	.	.	.	.	II+-4	III+-3	.	I +	V+-2	.	.	.	.	I+-2	r 2	r 1	r +	.
Quercus(Cyclobalanopsis) acuta	.	.	.	..	.	.	III+-4	III+-4	.	.	.	.	I+-3	I+-2	.	r +	.	.	.	.	.	.	.	.	..	.
Quercus(Cyclobalanopsis) sessiliforia	.	.	.	I+-2	.	.	I+-2	II+-1	.	.	.	r+-3	I+-1	I+-1	.	.	.	.	.	.	.	.	r +	.	.	.

Table 3. Synthesis table of pine forest communities and their neighboring communities in Hiroshima Prefecture

ler : Pinetalia densiflorae Suz.-Tok. 1966
. Alliance : Cladonio-Pinion densiflorae Toyohara 1979
I-1. Ass. : Cladio-aggregatae-Pinetum densiflorae, ass. nov.
I-1-A. Subass. : Juniperetosum rigidae
I-1-B. Subass. : Dicranopteridetosum linearis
I-1-C. : Acanthopanacetosum sciadophylloidis
I-2. Ass. : Davallio-Pinetum densiflorae Toyohara 1979
I-2-A. Subass. : Quercetosum glaucae
I-2-B. Subass. : Quercetosum grosseserratae
I. Alliance : Cyclobalanopsio-Pinion densiflorae Suzuki et Toyohara 1971
II-1. Ass. : Symploco-Pinetum densiflorae Toyohara et Suzuki 1975
II-1-A. Subass. : Myrsinetosum seguinii
II-1-B. Myrsine seguinii-Quercus acuta transitional comm.
II-1-C. Subass. : Quercetosum acutae
II-2. Ass. : Querco phillyraeoidis-Pinetum densiflorae, ass. nov.
II-3. Ass. : Querco glaucae-Pinetum densiflorae (Yoshioka 1958)
II-3-A. Subass. : Juniperetosum rigidae
II-3-B. Subass. : Dicranopteridetosum linearis
II-3-C. Subass. : Evodiopanacetosum innovans
II-4. Ass. : Querco salicinae-Pinetum densiflorae, ass. nov.
II-4-A. Subass. : Dicranopteridetosum linearis
II-4-B. Subass. : Hydrangetosum luteo-venosae
II-5. Ass. : Querco myrsinaefoliae-Pinetum densiflorae, ass. nov.
II-5-A. Subass. : Acanthopanacetosum sciadophylloidis
II-5-B. Subass. : Vaccinetosum japonicus
III. Alliance : Querco-Pinion densiflorae Suzuki et Toyohara 1971
III-1. Ass. : Tsugio sieboldii-Pinetum densiflorae (Yoshioka 1958)
III-2. Ass. : Rhododendro japonicum-Pinetum densiflorae, ass. nov.
III-3. Ass. : Querco grosseserratae-Pinetum densiflorae, ass. nov.
Deciduous broad-leaved secondary forests belonging to other orders
IV. Ass. : Castaneto-Quercetum crispulae Horikawa et Sasaki 1959
IV-1. Quercus mongolica var. grosseserrata-Castanea crenata community
IV-2. Quercus mongolica var. grosseserrata-Fagus crenata community
V. Quercus variabilis community
V-1. Quercus variabilis-Quercus glauca subordinate community
V-2. Quercus variabilis-Quercus myrsinaefolia subordinate community
Climatic climax community in warm-temperate regions
VI. Evegreen broad-leaved forest : Castanopsis cuspidata-Pasania glabra comm.
Climatic climax community in cool-temperate regions
VII. Deciduous broad-leaved forest : Lindero umbellatae-Fagetum crenatae (Sasaki 1964) Sasaki 1970

Vegetation units	I					II										III			IV		V			VI	VII
	1			2		1			2	3			4		5		1	2	3	1	2	1		2		
	A	B	C	A	B	A	B	C		A	B	C	A	B	A	B										
Number of records	18	33	28	18	19	313	24	60	21	48	140	97	85	68	197	56	23	30	97	17	31	24	41	22	21	11
Arundinella hirta	IV+-2	IV+-2	III+-2	.	.	.	.	.	II+-1	I+-3	I+-1	.	r+-1	r +	r+-3	r +	.	I+-2	.	.	.	.	.	.	.	.
Haloragis micrantha	I +	II+-1	II+-1	.	.	.	.	.	.	.	.	.	.	.	r +	r +	.	.	.	.	.	.	.	.	.	.
Polygara japonica	.	II+-1	II+-1	.	.	.	.	.	r +	I+-1	r +	.	r +	r +	r +	.	.	r +	.	.	.	.	.	.	.	.
Davallia mariesii	.	.	.	III+-1	III+-1	r +	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhododendron mucronulatum var. ciliatum	I 2	r 1	.	III+-3	IV+-3	.	.	.	I+-2	.	r +	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lepisorus thunbergianus	I +	r +	.	II +	II +	.	r +	r +	I +	II +	r +	r +	r +	.	r +	.	.	.	.	.	.	II +	I +	I +	I +	.
Bulbophyllum drymoglossum	.	.	.	II+-1	I +	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dendrobium moniliforme	.	.	.	II+-1	II +	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tripetaleia paniculata	.	.	.	III+-1	III+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1+-1	.	.	.	.	.	.
Sorbus gracilis	.	.	.	III+-1	V+-2	.	.	.	.	.	.	.	.	r +	.	.	.	r +	.	I +	.	.	.	.	.	.
Mecodium polyanthos	.	.	.	III+-1	II+-3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Enkianthus cernuus f. rubens	.	.	.	II+-1	III+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	I+-2	.	.	.	.	.	.	I+-2
Hymenophyllum barbatum	.	.	.	II+-2	II+-2	.	.	r +	.	.	.	.	.	.	.	.	r +	.	.	.	.	.	.	.	.	.
Cladonia rangiferina	IV+-3	V+-3	V+-4	V+-3	V+-2	.	.	.	.	.	.	.	.	.	r +	r +	.	.	.	.	.	.	.	.	.	.
Cladia aggregata	V+-3	V+-3	V+-3	III+-2	I +	.	.	.	.	.	r +	.	.	.	r +	.	.	.	.	.	.	.	.	.	.	.
Rhacomitrium canescens	III+-1	II+-1	I +	III+-1	II+-2	.	.	.	I +	r 1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Campylopus richardii	III+-2	II+-1	III+-1	II +	I +	.	.	.	II +	r 1	r +	.	.	.	r +	.	.	.	.	.	.	.	.	.	.	.
Wikstroemia sikokiana	I +	II+-1	II+-1	IV+-1	III+-1	I+-2	I +	I +	I+-1	.	I+-1	I+-1	I+-2	I+-1	.	r +	r +	.	.	.	.	.	.	.	.	.
Melampyrum laxum var. nikkoense	.	II+-1	I+-1	IV+-1	III+-1	I+-2	.	I +	.	.	r +	.	I +	I+-2	r +	I +	I +	I+-1	I +	I+-2	r +	.	.	.	.	.
Symplocos prunifolia	.	.	.	.	.	III+-5	V+-3	IV+-5	.	r +	r+-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Neolitsea aciculata	.	.	.	.	.	III+-5	IV+-1	IV+-3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Diospyros morrisiana	.	.	.	.	.	II+-3	III+-2	II+-2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Myrsine seguinii	.	.	.	.	.	IV+-5	V+-3	I +	.	r +	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Symplocos glauca	.	.	.	.	.	II+-4	II+-4	I+-3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Quercus(Cyclobalanopsis) salicina	.	.	.	III+-1	IV+-2	.	II+-3	IV+-5	.	.	.	.	II+-4	III+-3	.	I +	V+-2	.	.	.	.	I+-2	r 2	r 1	r +	.
Quercus(Cyclobalanopsis) acuta	.	.	.	.	.	.	III+-4	III+-4	.	.	.	.	I+-3	I+-2	.	r +	.	.	.	.	.	.	.	.	.	.
Quercus(Cyclobalanopsis) sessiliflora	.	.	.	I+-2	.	.	I+-2	II+-1	.	.	.	r+-3	I+-1	I+-1	.	.	.	.	.	.	.	.	r +	.	.	.
Quercus phillyraeoides	II+-1	.	.	.	.	II+-5	I+-4	.	V+-4	.	r 1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Myrica rubra	I +	I+-1	.	.	.	II+-3	II+-3	II+-2	III+-4	I+-2	r+-1	r +	r 1	.	.	.	.	.	.	.	.	.	r +	.	I+-1	.
Quercus(Cyclobalanopsis) glauca	III +	II+-1	I+-2	IV+-1	.	II+-3	IV+-4	IV+-4	II+-1	III+-4	IV+-4	IV+-3	IV+-2	III+-3	I+-3	.	.	.	.	.	.	V+-5	V+-5	I+-2	V+-4	.
Dicranopteris linearis	III+-5	IV+-5	r 4	I+-3	.	V+-5	IV+-5	II+-5	IV+-5	IV+-5	V+-5	II+-5	II+-5	.	.	.	.	.	.	.	.	r 1	r+-1	.	II+-2	.
Vaccinium bracteatum	II+-2	IV+-3	r 1	I +	.	II+-3	III +	II+-1	IV+-3	IV+-2	V+-2	IV+-2	IV+-2	.	.	.	.	.	.	.	.	.	II+-1	.	III+-1	.
Symplocos lucida	.	II+-1	.	.	.	III+-4	II+-2	III+-2	.	III+-4	III+-4	III+-3	III+-3	.	.	.	.	.	.	.	.	.	I+-2	.	IV+-3	.
Hydrangea luteo-venosa	.	r +	r 1	I +	I +	r +	I +	r +	.	.	II+-2	I+-2	IV+-3	V+-3	.	.	I+-1	.	I+-1	.	.	II+-1	III+-3	II+-2	II+-3	.
Illicium religiosum	.	.	.	II +	.	IV+-4	V+-2	V+-3	.	.	r+-2	I+-1	III+-3	III+-2	r 1	r +	r +	.	.	.	.	I+-1	r 2	I 2	II+-1	.
Symplocos myrtacea	.	.	.	.	.	.	I 1	.	.	.	.	.	II+-3	II+-2	.	.	.	.	.	.	.	.	.	.	.	.
Parabenzoin trilobum	.	.	I 1	.	.	.	.	.	.	.	.	.	I+-3	II+-4	.	.	.	.	.	.	.	.	.	.	.	.
Vaccinium japonicum	.	.	II+-2	IV+-3	V+-4	r +	.	.	.	.	r +	r+-1	II+-1	III+-1	I+-2	IV+-3	III+-2	IV+-2	III+-3	V+-1	III+-2	.	I +	I +	.	I +
Hydrangea hirta	.	r +	.	I +	II +	.	.	.	.	.	.	.	I+-2	III+-2	r +	II+-3	V+-1	II+-2	III+-2	V+-2	III+-2	.	r +	II+-2	.	I+-1
Magnolia salicifolia	.	I+-1	.	I +	II+-2	.	.	.	.	.	.	r +	III+-5	III+-3	r +	I+-1	IV+-3	I+-2	III+-3	V+-2	IV+-2	.	r +	.	III+-1	
Skimmia japonica	.	.	.	.	I+-1	.	.	r+-2	.	.	.	r +	I+-1	I+-1	.	r+-1	IV+-2	I +	II+-3	V+-3	II+-2	.	.	r 1	.	.
Mitchella undulata	.	I +	I +	II+-1	I +	I+-1	.	I +	.	r +	I+-2	II+-2	II+-1	r1-2	I+-1	II+-1	r +	I+-2	.	r +	.	.	.	I+-1	.	
Rhododendron semibarbatum	.	.	.	I+-3	II+-1	.	.	.	.	r +	r +	I+-2	I+-1	.	r +	III+-2	I+-1	II+-1	II+-2	r 1	.	.	r 2	.	.	
Carpinus laxiflora	.	.	.	I +	II+-3	.	.	.	.	.	r +	I+-2	II+-3	II+-4	I+-2	V+-3	II+-3	IV+-5	IV+-2	I+-1	r +	1+-2	II+-3	.	.	
Rhododendron lagopus	.	.	I+-3	III+-2	V+-3	.	.	r +	.	.	r+-2	.	I+-3	I+-1	.	r+-3	II+-2	III+-3	II+-3	I +	.	.	.	.	.	.
Quercus(Cyclobalanopsis) myrsinaefolia	.	r +	r +	.	.	.	.	.	.	.	.	r +	r+-1	r +	II+-2	I+-2	I +	.	.	.	.	I2-3	I+-3	III+-4	I+-1	.
Dioscorea gracillima	.	.	I +	.	.	.	.	.	.	r +	I +	I+-1	I+-1	III+-1	III+-1	I+-1	III+-1	1 +	I +	.	II+-1	II+-1	IV+-1	.	.	
Prunus grayana	.	.	.	.	.	.	.	.	.	r +	I+-1	I+-1	I +	II+-1	II+-1	II +	II+-2	II+-2	III+-1	II+-1	II+-1	I+-2	II+-2	I 2	I 1	
Maackia amurensis var. buergeri	I 1	.	r +	I +	I +	.	.	.	.	r+-1	I+-1	I +	II+-1	I+-1	II +	I+-I	I+-1	I +	.	I+-1	II+-1	II+-1	.	.	
Acanthopanax sciadophylloides	.	II +	II+-1	I +	I+-1	.	.	.	.	.	I+-2	IV+-3	III+-3	IV+-4	V+-5	V+-2	III+-2	III+-2	III+-2	IV+-1	V+-1	.	II+-2	II+-2	I+-1	II+-1
Ilex macropoda	.	I+-1	II+-2	I 1	I+-2	.	.	.	.	.	I+-3	III+-2	II+-3	II+-3	III+-3	IV+-2	IV+-2	I+-1	III+-3	III+-2	IV+-1	.	I+-2	II+-2	r +	I +
Sorbus japonica	I +	II+-1	II+-1	II+-1	IV+-1	r +	.	.	.	I +	I+-2	III+-2	III+-2	III+-2	III+-1	III+-1	I +	III+-2	III+-2	I+-1	r 1	II+-1	II+-2	.	.	
Evodiopanax innovans	.	II+-1	I+-1	III+-1	II+-2	.	.	.	.	.	r +	IV+-3	II+-2	II+-2	II+-3	III+-4	I +	I +	I+-1	.	.	.	r+-1	I +	.	.
Styrax japonica	.	I +	I+-2	I +	I +	.	r +	.	r +	I+-2	III+-2	III+-3	III+-2	II+-2	II+-2	II+-2	II+-1	I +	II+-2	III+-3	III+-2	.	.	.	.	.
Tripterospermum japonicum	.	I +	I +	I +	.	.	.	.	.	r +	III+-1	II +	III+-1	IV+-1	IV+-1	II +	II +	II +	II +	II +	.	.	.	I +	.	I +
Symplocos coreana	.	.	III+-1	.	I +	.	.	.	.	r +	I+-2	II+-2	IV+-2	III+-3	IV+-2	III+-1	V+-2	V+-2	V+-2	V+-3	I +	II+-2	III+-2	.	V+-3	
Lindera umbellata	.	.	r +	I +	I +	r +	.	.	.	r +	II+-1	II+-1	II+-1	II+-2	II+-1	IV+-1	III+-2	IV+-2	V+-3	V+-3	I +	II+-1	III +	.	V+-5	
Acer crataegifolium	.	I +	.	I +	III+-1	.	.	.	.	r +	r!-4	II+-3	III+-2	III+-3	II+-3	III+-2	V+-1	II+-2	III+-2	III+-1	r +	I +	II+-1	III+-2	.	.
Viola violaceae	.	I +	II +	I +	I +	r +	r +	r +	.	r +	I +	I +	II +	III +	II +	II +	II +	I +	.	r +	.	II +	I +	.	.	
Fraxinus lanuginosa	.	I+-2	I +	III+-2	III+-2	I+-1	I+-2	I+-2	.	.	r+-3	I+-1	III+-2	III+-2	I+-2	I+-1	V+-1	I +	III+-2	V+-1	II+-1	I+-1	I+-1	I +	.	V+-2
Ilex serrata	.	I +	II +	.	.	.	.	.	.	.	r +	I+-1	I+-1	I +	III+-1	II+-1	.	I +	I +	.	.	r +	I +	II +	.	
Callicarpa mollis	.	.	.	.	.	I +	II +	r +	.	r +	I+-1	r+-1	I+-1	r +	r +	r +	II +	.	r +	.	.	I+-1	II+-1	I +	I +	
Juniperus rigida	V+-4	V+-4	V+-3	III+-2	I +	I+-3	r 2	I+-1	V+-3	IV+-4	IV+-3	IV+-3	II+-3	I+-1	III+-3	III+-2	.	.	.	.	.	.	II+-2	I +	.	.
Quercus variabilis	III+-1	I+-1	II+-2	I +	I 1	.	.	.	I+-1	II+-2	II+-2	II+-2	I+-2	II+-3	III+-5	II+-2	I+-2	I 1	I+-3	.	.	V+-5	V1-5	III-5	I +	.
Arundinaria pygmaea	II +	III+-4	IV+-5	.	.	.	.	.	I+-1	II+-5	III+-5	IV+-3	II+-4	II+-5	V+-5	IV+-5	.	II+-1	I+-1	.	.	III+-1	IV+-3	I+-5	I+-2	.
Camellia japonica	.	I +	r 1	IV+-1	.	V+-4	V+-3	V+-3	r +	I+-2	II+-3	II+-2	IV+-3	III+-2	I+-2	I+-1	.	.	.	.	.	III+-3	III+-3	I+-3	IV+-2	.
Ligustrum japonicum	I +	.	.	.	.	III+-2	V+-1	IV+-2	II+-1	II+-1	II+-2	II+-2	II +	I +	r +	.	.	.	.	.	.	II+-2	III+-2	r +	III+-1	.
Ilex chinensis	.	.	.	.	.	.	.	.	r +	II+-3	II+-4	I+-2	r+-2	.	r+-1	.	.	.	.	.	.	II+-1	III+-2	r +	IV+-3	.
Rhus sylvestris	.	I+-1	.	.	.	I+-1	r 1	r +	II +	II+-1	II+-2	II+-1	I+-1	I+-2	r +	.	.	.	.	.	.	III+-2	III+-2	II+-1	IV+-2	.
Cleyera japonica	.	I+-1	I+-1	II+-1	III+-1	V+-5	V+-4	V+-4	.	I+-2	I+-3	II+-2	III+-4	II+-2	I+-2	.	.	.	.	.	.	.	I+-3	r +	IV+-3	.
Gleichenia japonica	I +	I+-1	.	III+-3	.	II+-5	II+-4	II+-2	.	I+-2	II+-5	II+-5	II+-5	r +	.	.	.	.	.	.	.	.	.	.	r +	.
Cinnamomum japonicum	.	.	.	.	.	II+-1	III+-2	IV+-3	.	.	I+-3	I +	II+-1	r +	.	r +	r +	.	.	.	.	r +	I +	.	III+-2	.
Pasania glabra	.	r +	.	.	.	II+-5	II+-3	.	.	r +	I+-3	I+-4	I+-2	r +	r 1	.	.	.	.	.	.	.	r+-3	.	IV+-5	.
Photinia glabra	.	I +	.	.	.	I+-2	III+-2	II+-1	.	I+-1	II+-3	II+-2	I+-2	r +	.	.	.	.	.	.	.	.	.	.	II+-1	.
Castanopsis cuspidata	.	.	.	.	.	II+-4	III+-2	III+-5	.	r +	I+-4	r+-2	I+-3	.	.	.	.	.	.	.	.	.	.	.	III+-5	.
Cinnamomum camphora	.	.	.	.	.	I+-2	II +	I +	.	I +	I+-1	r 1	.	.	.	.	.	.	.	.	.	r 1	.	.	III-3	.
Machilus(Persea) thunbergii	.	.	.	.	.	r +	.	r+-2	I +	r +	I+-3	I+-2	r+-1	r +	.	.	.	.	.	.	.	.	.	.	IV+-3	.
Ternstroemia gymnanthera	I +	.	.	.	.	I+-2	II+-2	I+-2	r +	I+-2	I+-1	r+-1	r+-1	.	r +	.	.	.	.	.	.	r +	.	.	II+-1	.
Dendropanax trifidus	.	.	.	.	.	I+-3	I +	r +	I+-1	II+-1	II+-2	I+-1	I+-1	r +	.	.	.	.	.	.	.	.	.	.	V+-3	.
Tsuga sieboldii	.	.	.	IV+-3	IV+-3	.	.	.	.	.	.	r 1	.	r 2	.	.	II+-3	.	r 1	II+-2	.	.	r 1	.	r 1	.
Chamaecyparis obtusa	.	.	I+-1	IV+-3	III+-4	r+-2	.	r +	.	r +	r+-4	I+-5	I+-4	I+-3	I+-5	I+-3	I+-1	I+-1	r +	.	.	.	r 1	I +	I+-5	.
Abies firma	.	.	.	I +	I +	r+-2	.	r +	.	.	.	r 1	I+-3	I+-2	r+-1	I +	I +	.	r +	I+-1	.	r +	I+-1	r +	r 2	.
Ardisia japonica	I +	r +	.	II +	II +	I+-2	III +	III +	I+-1	I+-3	III+-3	IV+-3	IV+-3	V+-2	III+-3	III+-3	IV+-1	I+-1	.	I +	.	IV+-3	V+-3	III+-1	IV+-1	.

9. Cleyera japonica	.	I+-1	I+-1	II+-1	III+-1	V+-5	V+-4	V+-4	.	I+-2	I+-3	II+-2	III+-4	II+-2	I+-2	.	.	.	.	.	.	.	I+-3	r+	IV+-3	.
Gleichenia japonica	I+	I+-1	.	III+-3	.	II+-5	II+-4	II+-2	.	I+-2	II+-5	II+-5	II+-5	r+	.	.	.	.	.	.	.	.	.	.	r+	.
Cinnamomum japonicum	.	.	.	.	.	II+-1	III+-2	IV+-3	.	.	I+-3	I+	II+-1	r+	.	r+	r+	.	.	.	.	r+	I+	.	III+-2	.
Pasania glabra	.	r+	.	.	.	II+-5	II+-3	.	.	r+	I+-3	I+-4	I+-2	r+	r1	.	.	.	.	.	.	.	r+-3	.	IV+-5	.
Photinia glabra	.	I+	.	.	.	I+-2	III+-2	II+-1	.	I+-1	II+-3	II+-2	I+-2	r+	.	.	.	.	.	.	.	.	.	.	II+-1	.
Castanopsis cuspidata	.	.	.	.	.	II+-4	III+-2	III+-5	.	r+	I+-4	r+-2	I+-3	.	.	.	.	.	.	.	.	.	.	.	III+-5	.
Cinnamomum camphora	.	.	.	.	.	I+-2	II+	I+	.	I+	I+-1	r1	.	.	.	.	.	.	.	.	.	r1	.	.	II1-3	.
Machilus(Persea) thunbergii	.	.	.	.	.	r+	.	r+-2	I+	r+	I+-3	I+-2	r+-1	r+	.	.	.	.	.	.	.	.	.	.	IV+-3	.
Ternstroemia gymnanthera	I+	.	.	.	.	I+-2	II+-2	I+-2	r+	I+-2	I+-1	r+-1	r+-1	.	r+	.	.	.	.	.	.	r+	.	.	II+-1	.
Dendropanax trifidus	.	.	.	.	.	I+-3	I+	r+	I+-1	II+-1	II+-2	I+-1	I+-1	r+	.	.	.	.	.	.	.	.	.	.	V+-3	.
Tsuga sieboldii	.	.	.	IV+-3	IV+-3	.	.	.	.	.	.	r1	.	r2	.	.	II+-3	.	r1	II+-2	.	.	r1	.	r1	.
Chamaecyparis obtusa	.	.	I+-1	IV+-3	III+-4	r+-2	.	r+	.	r+	r+-4	I+-5	I+-4	I+-3	I+-5	I+-3	I+-1	I+-1	r+	.	.	.	r1	I+	I+-5	.
Abies firma	.	.	.	I+	I+	r+-2	.	r+	.	.	.	r1	I+-3	I+-2	r+-1	I+	I+	.	r+	I+-1	.	r+	I+-1	r+	r2	.
Ardisia japonica	I+	r+	.	II+	II+	I+-2	III+	III+	I+-1	I+-3	III+-3	IV+-3	IV+-3	V+-2	III+-3	III+-3	IV+-1	I+-1	.	I+	.	IV+-3	V+-3	III+-1	IV+-1	.
Rhododendron japonicum	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	II+-1	I+-2	.	V+-2	.	.	.	.	r+	r+	.	.
Vaccinium ciliatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r+-3	I+-1	.	IV+-1	.	.	.	.	.	.	.	.
Quercus mongolica var. grosseserrata	.	.	.	.	II+-2	.	.	.	.	.	.	.	.	r+	.	.	III+-4	III+-4	III+-4	V+-5	V+-4	.	.	.	.	I+-2
Stewartia pseudo-camellia	.	I+-1	r+	I+	I+-1	.	.	.	.	.	.	.	.	r+-1	r+	I+-2	IV+-2	II+-1	II+-3	IV+-3	IV+-3	.	.	.	.	I+-1
Acer sieboldianum	.	.	.	.	I+	.	.	.	.	.	.	.	r+-1	I+-2	.	.	IV+-2	II+-1	III+-2	V+-2	V+-2	.	.	.	.	I+
Cornus kousa	.	.	.	.	.	r+	I+	.	.	.	r+-1	r+-2	I+-1	I+-1	I+-1	I+-1	III+-2	III+-1	III+-2	IV+-2	III+-1	r1	r+-1	I+-1	.	I1
Fagus japonica	.	.	.	.	I+	.	.	.	.	.	.	.	.	.	.	.	III+-4	II+-3	II+-5	IV+-5	r2	.	.	.	.	.
Stylax obassia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II+-3	.	I+-1	II+-2	III+-2	.	.	.	.	I+
Carpinus tschonoskii	.	.	.	.	I+	.	.	.	.	.	.	.	r3	.	r+*2	.	I2-4	r1	I+-4	II+-3	III+-3	.	.	II+-1	.	.
Carpinus japonica	.	.	.	.	.	.	.	.	.	.	.	.	.	r1	r+	.	r2	.	I1-2	II+-2	III+-2	.	.	.	.	.
Sasa veichii var. hirsuta (incl. S. palmata)	.	.	.	.	I+	.	.	.	.	.	.	.	.	I+-5	r+-3	I+-1	V+-5	IV+-5	IV+-5	V+-5	V+-5	r3	r+-1	II+-1	.	IV+-5
Corylus sieboldiana	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	I+-1	I+	I+	II+-2	II+-2	II+	V+-1	.	r+	II+-1	.	V+-1
Cephalotaxus harringtonia var. nana	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	.	.	II+-1	r+	II+-1	III+-1	IV+-3	.	.	.	.	V+-1
Viburnum furcatum	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	.	.	I+	II+	II+-1	III+-2	V+-1	.	.	.	.	V+-2
Fagus crenata	.	.	.	.	.	.	.	.	.	.	.	.	.	r2	.	.	II+-2	.	I+-2	IV+-4	V+-5	.	.	.	.	V3-5
Rhus ambigua	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	.	.	I+-1	I+	I+	II+-1	V+-2	.	.	.	.	V+-3
Acer japonicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+-1	.	I+-1	IV+-2	IV+-2	.	.	.	.	I+
Schizophragma hydrangeoides	.	.	.	I+	I+	.	.	.	.	.	.	r+	r+	r+	r+-1	.	II+-1	I+-2	II+-1	III+-1	V+-2	I+	I+	r+	.	V+-2
Acer rufinerve	.	.	.	.	.	II+-3	III+-1	III+-2	.	.	r+	r1	I+	.	r+-1	.	I+-1	I+	I+-1	II+-1	V+-2	.	.	.	.	III+-2
Acer mono	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	r+	I+	II+	IV+-2	r+	.	.	.	III+-1
Carex foliosissima	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r1	.	r+	II+	III+-2	.	.	.	.	III+-3
Sorbus commixta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r+-2	I+-1	I+-2	.	I+-2	.	.	.	.	II+
Euonymus lanceolatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II+	.	I+	III+	IV+	.	.	.	.	I+-1
Daphniphyllum macropodum var. humile	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III+-2	r+	I+-1	III+-3	r+	.	.	.	.	.
Viburnum phlebotrichum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II+-1	I+-2	III+-1	II+-1	.	.	.	.	I 2
Pieris japonica	.	V+-2	V+-3	V+-2	V+-3	IV+-4	III+-2	III+-2	.	.	III+-4	V+-3	V+-2	V+-3	V+-4	V+-3	V+-3	IV+-4	V+-4	V+-3	.	.	IV+-3	IV+-3	I+	.
Ilex pedunculosa	.	V+-3	V+-3	V+-2	V+-3	IV+-5	IV+-4	IV+-3	II+-1	.	III+-3	V+-4	V+-4	V+-4	V+-4	V+-4	V+-4	IV+-3	V+-4	III+-2	.	.	III+-2	III+-2	.	.
Vaccinium smalii var. glabrum	.	IV+-2	III+-2	III+-2	IV+-3	r+	.	r+	.	.	III+-3	V+-2	IV+-2	V+-3	IV+-2	IV+-2	II+-1	III+-1	III+-1	II+	I+	I+	III+-1	II+-1	I+	.
Rhamnus crenata	.	III+-1	IV+-1	III+	II+	II+-2	II+-2	II+-1	.	.	II+-2	II+-1	II+-1	II+-1	III+-1	III+-1	I+	III+	II+-1	I+	I+	.	I+-1	I+-1	.	.
Ilex crenata	..	IV+-2	V+-3	I+	.	.	.	.	.	.	III+-2	V+-3	V+-2	V+-2	V+-2	V+-3	II+-1	V+-3	IV+-3	I+-1	IV+-1	III+-1	IV+-1	IV+-1	I+	IV+-1
Clethra barbinervis	.	II+-1	IV+-3	IV+-2	V+-2	I+-4	I+-1	II+-3	.	.	II+-4	II+-2	IV+-4	V+-3	III+-4	IV+-4	V+-2	IV+-3	V+-4	V+-3	V+-3	r1	II+-2	III+-3	I+	II+
Pinus densiflora	V1-5	V2-5	V2-5	V1-5	V1-4	V+-5	V+-5	V1-5	V2-5	V2-5	V+-5	V2-5	V+-5	V1-5	V+-5	V1-5	III+-5	IV+-5	IV+-5	.	r1	I+-2	III+-5	III+-4	I+-1	.
Quercus serrata	IV+	V+-3	V+-3	V+-1	IV+-3	.	.	.	III+-3	IV+-2	IV+-3	IV+-5	V+-3	V+-5	V+-5	V+-5	V+-5	V+-5	V+-5	I+-3	r1	III+-4	V+-4	V1-5	I+-2	.
Lyonia ovalifolia var. elliptica	V+-3	V+-3	V+-3	V+-2	V+-3	IV+-4	II+-1	III+-3	V+-3	V+-5	V+-5	V+-4	V+-3	V+-4	IV+-4	V+-3	IV+-2	III+-2	IV+-3	III+-3	I1	.	IV+-3	III+-2	I+	.
Rhododendron reticulatum	V+-3	V+-4	V1-5	II+-3	II+-2	I+-3	I+-2	I+	V+-3	V+-5	V+-3	V+-4	V+-5	V+-5	V+-4	V2-4	V+-4	IV+-4	V+-4	V+-3	.	II+-3	V+-4	V+-4	.	.
Smilax china	IV+	V+-2	V+-1	V+	II+	V+-2	V+	V+	V+-2	V+-2	V+-2	V+-2	V+-1	V+-2	V+-2	V+-2	V+	V+-1	V+-2	III+	I+	IV+-1	V+-2	V+-1	III+-1	.
Rhododendron kaempferi	V+-3	V+-2	V+-3	V+-2	V+-3	II+-2	I+	I+-1	IV+-3	V+-2	IV+-3	V+-3	III+-2	III+-2	IV+-2	V+-4	II+-1	II+-2	II+-2	.	.	I+-1	IV+-3	III+-2	r+	.
Vaccinium oldhamii	IV+-2	V+-2	V+-3	IV+-2	IV+-3	r+	.	r+	III+-1	III+-3	IV+-3	IV+-2	III+-2	IV+-2	IV+-3	V+-3	I+-1	IV+-2	III+-2	.	.	.	III+-1	II+-1	.	.
Pteridium aquilinum var. latiusculum	I+-1	III+-1	IV+-2	I+	I+	r+	r+	.	II+	II+-2	III+-1	III+-1	III+-1	IV+-1	IV+-2	IV+-2	II+	IV+-3	III+-2	I+	I+	.	II+	III+	.	.
Miscanthus sinensis	V+-2	V+-3	V+-2	V+-1	IV+-1	II+-3	r+	I+	V+-3	V+-3	IV+-3	II+-1	II+-3	II+-3	III+-1	III+-3	r+	III+-3	I+	.	r+	I+-1	II+	I+	r+	.
Lespedeza bicolor	IV+-1	V+-1	IV+-2	II+	III+-1	I+	.	.	III+-1	IV+-2	III+-1	II+-1	II+	II+-2	III+-4	III+-2	r+	III+	I+-2	.	.	.	I+	I+	.	.
Amelanchier asiatica	I+	I+-2	III+-1	II+-1	IV+-1	I+-2	.	.	IV+-1	III+-3	III+-2	II+-1	II+-1	III+-1	III+-2	III+-2	III+-1	II+-1	II+-1	II+	.	I+-1	I+-1	III+-1	r1	.
Castanea crenata	I+-1	II+-2	IV+	I+-1	I+	.	.	.	I+	III+-3	II+-2	III+-3	III+-2	IV+-2	IV+-3	IV+-3	II I	V+-3	IV+-3	III+-2	II+-3	I+-1	IV+-4	III+-2	r+	.
Pourthiaea villosa var. laevis	.	II+-2	III+-2	I+-1	I+	I+-1	I+	I+-2	r+	II+-1	II+-1	III+-3	IV+-2	IV+-2	III+-2	IV+-2	III+-1	II+-1	III+-1	III+-2	III+-2	III+-1	III+-1	III+-2	I+	I+
Rhus trichocarpa	IV+	V+-1	IV+-2	IV+-2	V+-1	IV+-1	III+	III+	V+-2	V+-2	V+-3	V+-3	V+-2	V+-3	V+-3	V+-2	V+-1	V+-2	V+-4	V+-2	II+-2	II+-1	V+-3	III+-2	II+	.
Viburnum wrightii	III+	IV+	IV+-2	IV+	V+-1	III+-1	II+	III+	IV+-1	III+-2	IV+-3	IV+-2	IV+-1	IV+-1	IV+-2	V+-1	V+-2	V+-2	V+-1	IV+-2	V+-2	I+	II+-1	II+-1	I+-1	II+-2
Viburnum erosum	I+	II+-1	III+-1	.	.	.	.	.	I+	III+-1	II+-1	IV+-2	IV+-2	V+-1	IV+-2	IV+-2	IV+	IV+-2	IV+-2	II+-1	r+	IV+-1	V+-2	IV+-2	II+	.
Lindera glauca	.	.	.	r+	.	.	.	.	r+	I+	I+	I+-1	r+-1	I+	I+-1	I+	I+	.	r+	.	.	IV+-1	IV+-1	III+-2	r+	.
Lonicera gracilipes var. glabra	.	.	.	.	.	.	.	.	.	r+	r+	r+	I+	I+-1	I+-1	r+	I+-1	I+	I+	.	r+	III+-1	I+	III+-1	.	.
Quercus aliena	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+-1	r+	.	r1	.	.	.	III+-3	II+-2	III+-2	.	.
Ligustrum obtusifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	.	.	.	.	.	.	III+-2	II+-2	II+-1	.	.
Platycarya strobilacea	.	.	.	.	.	.	.	.	.	.	r+	.	.	r+	r+-1	.	.	.	.	.	.	IV+-4	I+-3	II+-3	.	.
Albizzia julibrissin	.	.	.	.	.	.	.	.	.	I+	r+-1	r+	r1-2	r+-1	II+-3	II+-3	r+	I+	r+	.	.	III+-1	IV+-2	I+-1	r1	.
Cephalotaxus harringtonia	.	.	.	.	.	r+	.	.	.	.	.	.	r+-1	r+	r+	.	.	.	.	.	.	III+-1	I+	II+-2	.	.
Kerria japonica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II+-3	r+-1	II+-1	.	.
Dryopteris lacera	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II+-1	I+	r+	.	.
Zelkova serrata	.	.	.	.	.	.	.	.	.	r+	.	.	.	.	r1	.	.	.	.	.	.	III+-3	.	I+-3	.	.
Lonicera gracilipes	.	.	.	.	.	.	.	.	.	r+	r+	I+-1	I+	I+	I+-1	r+	r+	.	I+-1	.	r+	I+-1	I+-1	II+	.	.
Elaeagnus pungens	.	.	.	.	.	.	.	.	I+-2	I+	I+-1	r+-1	r+	r+	I+-1	I+	r+	.	.	.	.	V+-2	IV+-2	IV+-1	II+-1	.
Oplismenus undulatifolius	.	.	.	.	.	.	.	.	r+	I+-1	I+-1	r+	r+	r+	r+-1	.	.	.	.	.	.	IV+-2	II+-1	II+-1	III+-1	.
Ardisia crenata	.	.	.	.	.	II+-1	IV+	II+	.	I+	II+-1	II+-1	r+	r+	r+	.	.	.	.	.	.	r+	I+	.	IV+-1	.
Ficus erecta	.	.	.	.	.	r+	.	.	r+	I+-2	I+-1	r+	.	.	.	.	.	.	.	.	.	r2	I+-1	.	III+-2	.
Dryopteris erythrosora	.	.	.	.	.	I+-2	I+	I+	.	I+-3	I+-3	I+	r+	r+	r+	.	.	.	.	.	.	III+-2	II+-1	r+	V+-5	.
Trachelospermum asiaticum	.	r+	.	I+	I+	III+-2	III+-1	IV+-2	.	I+-3	I+-3	I+-1	I+-2	r+	I+-2	I+	.	.	.	.	.	V+-5	III+-3	II+-1	V+-4	.
Dryopteris varia var. setosa	.	.	.	.	.	r+	.	r+	.	I+	I+-1	r+	.	.	.	.	I+	.	.	.	.	III+-1	I+-1	I+	I+-1	.
Hedera rhombea	.	.	.	.	.	.	.	.	.	r+	r+-1	r+	.	.	r+	.	.	.	.	.	.	IV+-3	II+-2	II+	II+-1	.
Liriope platyphylla	.	.	.	.	.	r+	.	.	.	I+	I+	r+	r+	.	r+	.	.	.	.	.	.	III+-2	I+-1	.	II+	.
Trachycarpus fortunei	.	.	.	.	.	.	.	.	I+	r+	I+	r+	.	.	r+	r+	.	.	.	.	.	I+	r1	I+	II+	.
Aucuba japonica	.	.	.	.	.	.	.	.	.	r+	.	.	.	.	r+-1	.	.	.	.	.	.	I+-1	r+	.	II+	.
Fatsia japonica	.	.	.	.	.	.	.	.	.	I+	r+	r+	.	.	.	.	.	.	.	.	.	r+	.	.	II+	.
Neolitsea sericea	.	.	.	.	.	III+-3	V+-1	IV+-2	.	I+	I+	I+-1	I+	r+	r+-1	.	.	.	r+	.	.	II+-1	I+	I+-2	II+-2	.
Kadsura japonica	.	.	.	.	.	.	.	.	.	.	r+	.	.	.	r+	r+	.	.	.	.	.	II+-1	I+-1	r+	III+-1	.
Parthenocissus tricuspidata	.	.	.	.	.	I+-2	.	r+	.	I+-3	I+-3	I+	r+	r+	r+	.	.	.	.	.	.	III+-2	II+-1	r+	I+-1	.
Ophiopogon japonicus	.	.	.	.	.	.	.	.	.	I+-1	I+-1	I+	r+	.	I+-1	.	r+	.	.	.	.	V+-2	IV+-2	III+-2	V+-1	.
Eurya japonica	IV+-3	V1-3	V+-2	IV+-2	III+-1	V+-5	V+-5	V+-3	V+-4	V+-3	V1-5	V1-4	V+-4	V+-4	V+-4	V1-4	V+-2	II+-2	III+-3	III+-1	r+	IV+-2	V+-3	IV+-1	V+-3	.
Cymbidium goeringii	I+	I+-1	II+	I+-1	I+	r+	r+	.	II+	III+-2	III+-1	IV+-1	III+-1	III+	IV+-1	II+-1	II+	II+	I+	.	.	III+	IV+-1	IV+-1	II+	.
Akebia trifoliata	I+	r+	.	I+	.	I+-2	I+-1	I+-1	I+	I+	I+-1	I+-1	I+-1	I+-2	II+-2	I+	I+-1	I+	I+-1	I+	r+	IV+-1	III+-2	IV+-1	I+	.
Wisteria floribunda	I+	.	r1	.	.	.	r+	.	r1	II+-2	II+-3	II+-2	I+-1	I+-2	II+-3	II+-1	III+-2	I+-1	I+-2	.	.	IV+-2	III+-2	V+-2	III+-1	.
Paederia scandens var. mairei	I+	r+	r+	.	.	III+	III+	I+	III+-1	II+-1	II+-2	I+	I+	I+	II+-1	r+	r+	r+	r+	.	.	III+-1	III+-1	III+-1	IV+	.
Ligustrum tschonoskii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	.	III+	.	.	.	.	V+-1
Hydrangea macrophylla var. acuminata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	.	.	.	.	V+-3
Polystichum retroso-paleaceum var. ovato-paleaceum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V+-1
Athyrium otophorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V+
Polystichum tripteron	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V+-1
Smilacina japonica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	.	.	.	.	IV+-1
Oxalis griffithii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV+-1
Peracarpa carnosa var. circaeoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	.	.	.	.	IV+-1
Acer shirasawanum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV+-2
Rubus pectinellus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	I+	.	.	.	.	III+-1
Polystichum retroso-paleaceum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+-1	.	.	.	.	III+-1
Ilex geniculata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	.	.	I+	.	.	.	.	III+-2
Hydrangea petiolaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I+	.	.	.	.	.	III+-2
Acer argutum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III+-2
Rubus peltatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III+
Plagiogyria matsumureana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	.	.	I+	I+-1	.	.	.	.	II+-2
Rumohra standishii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II+-3
Carex dolichostachya var. glaberrima	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r+	I+	I+-1	.	.	.	.	II+-2
Cacalia yatabei var. occidentalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II+-3
Sorbus alnifolia	I+	.	.	.	.	r+	.	.	II+	r+	r+	I+-1	r+-1	r+	I+	I+-1	I1	III+-2	II+-1	III+-2	V+-3	r+	.	.	.	I1
Euonymus alatus f. ciliatodentatus	.	.	.	.	.	.	.	.	.	r+	r+	r+	r+	I+	I+-1	I+	II+-1	III+-1	II+-3	II+	IV+-1	III+-2	II+-2	III+	.	IV+-1
Magnolia obovata	.	.	r1	.	.	.	.	.	.	.	r+	r+	I+-3	II+-1	I+-1	I+-2	II+-2	II+-1	II+-2	II+-2	IV+-1	.	I+-2	II+-2	r+	IV+-2
Euonymus oxyphyllus	.	.	.	.	.	.	.	.	.	.	.	r+	r+	I+	r+-1	r+	I+-1	I+-1	I+-1	II+	III+-1	II+-1	I+-2	III+-1	.	I+
Lindera obtusiloba	.	.	.	I+	II+-1	.	.	.	.	.	r+	r+	r+-1	I+-1	I+-1	I+-1	IV+-1	II+-1	II+-1	III+-1	r+	IV+-1	II+-1	III+-2	.	.
Abelia serrata	II+-1	II+-3	II+-1	II+-1	II+	r+	.	r+	III+-2	I+-1	II+-2	II+-2	II+-1	II+-2	II+-2	IV+-1	II+	III+-2	II+-1	I+	.	.	r+-2	I+	.	.
Solidago virga-aurea var. asiatica	II+	IV+-1	III+	II+-1	II+	r+	.	.	III+-1	III+-1	II+-1	II+	II+	II+	III+-2	II+-2	r+	II+	I+	I+-1	I+	I+	II+	I+	I+	.
Pertya scandens	.	I+	II+-1	I+	I+	r+-1	.	.	I+-2	II+-4	II+-3	I+-2	III+-1	III+-4	II+-2	I+	.	r+	r+	.	.	I+	III+-2	I+	II+	.
Prunus jamasakura	I+	II+	II+-1	I+	.	I+-2	.	I+-1	II+-1	II+-1	II+-1	II+-2	II+-2	II+-2	III+-2	II+-2	II+-2	I+-2	II+-1	II+-1	II+-2	II+-1	III+-2	III+-1	I+-2	.
Disporum smilacinum	.	.	.	.	.	.	.	.	.	.	r+	r+-3	I+-3	II+-3	I+-1	II+-3	III+-2	III+-2	III+-4	V+-2	III+-3	.	r+	I+-1	.	.
Platanthera minor	.	II+	I+	.	.	I+	I+	I+	.	I+	II+	III+-1	III+	III+	II+	III+	II+	III+	II+	I+	I+	.	I+	II+	.	.
Schisandra repanda	.	.	.	I+	.	I+-1	I+-1	I+-2	.	r+	.	r+-1	I+-1	I+-1	r+	r+	II+-1	I+-1	I+-1	II+-1	III+-1	r+	I+	II+-1	.	.
Blechnum niponicum	.	I+	II+	I+	II+	r+	.	r+	r+	r+	II+-1	III+-1	III+-2	IV+-2	IV+-3	V+-4	V+-2	IV+-3	V+-2	V+-1	V+-2	II+-2	IV+-2	IV+-4	III+-1	II+

Table 4. Synthesis table of forest communities in the coastal region of Hiroshima Prefecture

Cladonio-Pinion densiflorae
- I. Cladio aggregatae-Pinetum densiflorae
  - I-1. Juniperetosum rigidae
  - I-2. Dicranopteridetosum linearis

Cyclobalanopsio-Pinion densiflorae
- II. Querco phillyraeoidis-Pinetum densiflorae
- III. Querco glaucae-Pinetum densiflorae
  - III-1. Juniperetosum rigidae
    - III-1-A. Typical variant
      - III-1-A-a. Typical subvariant
        - III-1-A-a-i. Juniperus rigida group
        - III-1-A-a-ii. Arundinella hirta group
          - (1) Typical subgroup
          - (2) Rhus javanica subgroup
          - (3) Erechtites hieracifolia subgroup
      - III-1-A-b. Symplocos lucida subvariant
        - III-1-A-b-i. Juniperus rigida group
          - (1) Typical subgroup
          - (2) Rhus javanica subgroup
        - III-1-A-b-ii. Arundinella hirta group
          - (1) Typical subgroup
          - (2) Rhus javanica subgroup
          - (3) Erechtites hieracifolia subgroup
          - (4) Polygala japonica subgroup
    - III-1-B. Ardisia japonica variant
      - (1) Typical subgroup
      - (2) Rhus javanica subgroup
  - III-2. Dicranopteridetosum linearis
    - III-2-A. Typical variant
      - III-2-A-a. Typical subvariant
        - III-2-A-a-i. Juniperus rigida group
        - III-2-A-a-ii. Arundinella hirta group
          - (1) Typical subgroup
          - (2) Rhus javanica subgroup
          - (3) Erechtites hieracifolia subgroup
          - (4) Polygala japonica subgroup
      - III-2-A-b. Symplocos lucida subvariant
        - III-2-A-b-i. Juniperus rigida group
          - (1) Typical subgroup
          - (2) Rhus javanica subgroup
        - III-2-A-b-ii. Arundinella hirta group
          - (1) Typical subgroup
          - (2) Rhus javanica subgroup
          - (3) Erechtites hieracifolia subgroup
          - (4) Polygala japonica subgroup
    - III-2-B. Ardisia japonica variant
      - III-2-B-a. Typical subvariant
        - III-2-B-a-i. Juniperus rigida group
          - (1) Typical subgroup
          - (2) Rhus javanica subgroup
        - III-2-B-a-ii. Arundinella hirta group
          - (1) Rhus javanica subgroup
          - (2) Erechtites hieracifolia subgroup
      - III-2-B-b. Ardisia crenata subvariant
        - III-2-B-b-i. Juniperus rigida group
          - (1) Typical subgroup
          - (2) Rhus javanica subgroup
        - III-2-B-b-ii. Arundinella hirta group

Evergreen broad-leaved forest
- IV. Castanopsis cuspidata-Pasania glabra community
  - IV-1. Pinus densiflora group
  - IV-2. Typical group

Vegitation units	I		II	III																										IV	
				1								2																			
				A						B		A												B							
				a			b					a				b								a				b			
				i	ii		i		ii			i	ii			i		ii						i		ii		i		ii	
					(1)	(2)	(3)	(1)	(2)			(1)	(2)				(1)	(2)	(1)	(2)	(3)	(4)			(1)	(2)	(1)	(2)	(1)	(2)		
Stands fired																															
Number of records	18	17	21	8	11	5	24	10	7	10	12	11	16	5	10	29	25	17	3	12	13	11	13	35	9	3	11	45	15	5	14	21
1. Cladonia rangiferina	IV	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cladia aggregata	V	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.
Campylopus richardii	III	III	II	.	.	.	r	.	II	.	.	.	.	I	.	.	.	.	I	.	I	.	.	.	.	.	.	.	r	.	.	.
Rhacomitrium canescens	III	II	I	.	I	.	.	I	.	.	.	.	.	.	r	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.
Wikstroemia sikokiana	.	III	I	I	II	.	I	II	.	II	.	.	III	II	I	.	.	II	I	III	IV	I	I	r	.	.	.	.	.	.	.	.
Melampyrum laxum var. nikkoense	.	II	.	.	I	.	.	.	.	.	.	.	I	.	.	I	.	.	.	I	I	.	.	.	.	.	.	.	I	.	.	.
2. Quercus phillyraeoides	II	.	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Myrica rubra	I	I	III	I	.	.	I	.	II	.	I	I	.	.	.	.	.	I	.	.	.	I	.	r	.	.	.	I	I	.	I	I
3. Vaccinium bracteatum	II	IV	IV	II	IV	V	IV	V	III	III	V	V	IV	IV	III	V	V	V	2	IV	IV	V	III	IV	IV	2	V	IV	V	III	III	III
Dicranopteris linearis	III	IV	IV	V	IV	V	V	V	V	III	III	IV	V	V	IV	IV	IV	V	3	IV	V	V	V	V	V	3	V	IV	IV	III	II	II
4. Pieris japonica	.	V	.	.	.	.	.	.	.	.	.	.	III	III	II	III	III	III	2	III	III	II	IV	V	III	3	IV	III	II	I	IV	I
Ilex pedunculosa	.	IV	II	.	.	.	.	.	.	.	.	.	III	.	II	I	r	IV	1	III	II	I	I	IV	III	.	II	II	II	I	III	.
Vaccinium smallii var. glabrum	.	III	.	.	.	.	.	.	.	.	.	.	III	III	III	I	II	II	1	II	I	.	II	III	II	1	I	III	III	I	II	I
Rhamnus crenata	.	III	.	.	.	.	.	.	.	.	.	.	II	I	III	III	I	II	2	IV	IV	III	III	II	II	3	II	I	III	V	I	.
5. Ilex crenata	.	IV	.	.	.	.	.	.	.	.	.	.	III	III	III	III	II	I	1	III	IV	IV	II	III	IV	2	IV	III	I	II	II	I
Clethra barbinervis	.	I	.	.	.	.	.	.	.	.	.	.	I	II	I	r	I	II	.	III	I	I	II	III	I	3	I	II	.	I	I	I
6. Ardisia japonica	I	.	I	.	.	.	.	.	.	.	II	III	.	.	.	.	.	.	.	.	.	.	.	III	III	.	II	IV	IV	I	V	IV
Dendropanax trifidus	.	.	I	.	.	.	.	.	.	.	III	III	.	.	.	.	.	.	.	.	.	.	.	III	II	3	I	II	IV	I	III	V
Ilex chinensis	.	.	r	.	.	.	.	.	.	.	IV	III	.	.	.	.	.	.	.	.	.	.	.	II	II	.	I	III	II	I	III	IV
Elaeagnus pungens	.	.	I	.	.	.	.	.	.	.	II	I	.	.	.	.	.	.	.	.	.	.	.	I	II	.	I	II	II	.	II	II
Blechnum niponicum	I	.	r	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	I	III	.	I	II	II	.	III	III
Oplismenus undulatifolius	.	.	r	.	.	.	r	.	.	.	I	II	.	.	.	I	.	.	I	.	.	.	I	I	II	.	I	I	II	II	I	III
7. Ardisia crenata	.	.	.	.	.	.	.	.	.	.	II	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	III	II	III	IV
Ficus erecta	.	.	r	.	.	.	.	.	.	.	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	III	II	I	III
Dryopteris erythrosora	.	.	.	.	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	III	.	III	V
Parthenocissus tricuspidata	.	.	.	.	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	II	.	II	I
Trachelospermum asiaticum	.	.	.	.	.	.	.	.	.	.	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	II	IV	V
Ophiopogon japonicus	.	.	.	.	.	.	.	.	.	.	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	.	III	V
Dryopteris varia var. setosa	.	.	.	.	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	II	.	I	I
Hedera rhombea	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	I	III
Liriope platyphylla	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	r	.	II	II
Trachycarpus fortunei	.	.	I	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	II	II
8. Symplocos lucida	.	I	.	.	.	.	.	IV	III	III	II	II	.	.	.	.	.	III	2	IV	II	III	IV	IV	II	3	IV	III	V	II	V	IV
Quercus glauca	III	I	II	.	.	.	.	II	II	I	IV	V	.	.	.	.	.	III	1	III	III	I	II	IV	III	3	I	V	IV	III	V	V
Ligustrum japonicum	I	.	II	.	.	.	.	I	.	II	II	III	.	.	.	.	.	I	1	.	.	.	I	I	III	.	I	III	III	II	IV	III
Camellia japonica	.	r	r	.	I	.	.	.	.	.	I	I	.	.	.	.	.	I	.	II	.	I	II	III	II	.	I	III	II	II	V	IV
Cleyera japonica	.	I	.	.	.	.	.	.	.	.	I	I	.	.	.	.	.	I	I	.	I	I	.	I	I	I	I	II	II	.	IV	IV
Rhus sylvestris	.	II	.	.	.	.	.	I	III	II	III	III	.	.	.	.	.	II	.	I	I	II	I	II	III	.	.	III	IV	II	II	IV
Cinnamomum japonicum	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	2	.	I	II	I	III	III
Pasania glabra	.	.	.	.	.	.	.	.	I	.	I	.	.	.	.	.	.	I	.	I	II	.	.	I	.	.	.	II	.	.	II	IV
Photinia glabra	.	I	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	I	.	I	I	.	.	II	.	.	.	II	II	.	III	II
Castanopsis cuspidata	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	I	.	I	I	.	.	I	.	.	.	I	II	.	III	III
Cinnamomum camphora	.	.	.	.	.	.	.	II	I	I	I	I	.	.	.	.	.	I	.	I	.	.	II	I	.	.	.	I	II	.	II	II
Machilus(Persea) thunbergii	.	.	I	.	.	.	.	I	.	.	.	I	.	.	.	.	.	I	.	.	.	.	.	r	.	.	.	I	II	.	II	IV
Ternstroemia gymnanthera	.	r	r	.	.	.	.	I	.	.	I	I	I	.	.	.	.	I	.	I	.	.	.	r	.	.	.	r	I	.	I	II
9. Juniperus rigida	V	V	V	IV	I	.	r	V	V	.	IV	IV	IV	II	I	.	.	IV	2	.	II	.	.	IV	III	.	.	IV	III	I	.	.
10. Arundinella hirta	IV	V	II	.	V	IV	V	.	III	IV	.	I	II	IV	III	IV	IV	II	.	II	IV	III	V	.	.	.	II	.	.	V	.	.
Lespedeza cyrtobotrya	.	I	r	II	II	III	IV	.	.	III	.	I	.	I	II	III	V	.	1	III	III	IV	IV	.	I	3	IV	r	.	II	.	.
11. Zanthoxyrum schinifolium	.	I	I	I	.	III	II	.	III	III	.	I	.	.	III	III	II	.	2	.	III	III	IV	.	III	1	IV	.	I	III	.	.
Rhus javanica	I	r	.	.	.	.	III	.	III	III	.	II	.	.	II	III	II	.	2	.	IV	V	IV	.	IV	2	V	.	II	III	.	r
Mallotus japonica	.	.	.	.	.	I	III	.	I	IV	.	III	.	.	II	IV	III	.	.	.	III	IV	IV	.	II	2	V	.	III	V	I	II
Lysimachia clethroides	.	I	.	.	.	I	II	.	.	II	.	I	.	.	.	III	III	.	.	.	I	III	III	.	III	.	IV	.	.	.	.	.
Aralia elata	.	I	I	.	.	.	II	.	.	II	.	IV	.	.	.	III	II	.	.	.	I	II	III	.	II	1	III	.	II	III	I	I
12. Alnus sieboldianus	I	.	r	.	II	III	V	I	.	III	.	.	I	.	III	III	V	I	2	I	II	V	IV	.	I	.	IV	r	I	II	.	.
Alnus pendula	I	I	.	.	I	.	.	.	.	.	.	.	.	I	.	r	.	.	.	.	.	.	.	.	I	.	.	I	.	.	.	.
13. Erigeron canadensis	.	.	.	.	.	.	V	.	.	III	.	.	.	.	V	V	.	.	.	.	.	V	V	.	.	.	V	.	.	III	.	.
Erechtites hieracifolia	.	.	.	.	.	.	III	.	.	II	.	.	.	III	II	.	.	.	.	.	IV	II	.	.	.	.	II	.	.	IV	.	.
Erigeron sumatrensis	.	.	.	.	.	.	II	.	.	I	.	I	.	I	I	.	.	.	.	.	I	I	.	.	.	.	I	.	.	IV	.	.
Digitaria adscendens	.	.	.	.	.	.	I	.	.	II	.	.	.	I	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	I	.	.
Artemisia princeps	.	.	.	.	.	.	I	.	.	I	.	.	.	II	I	.	.	.	.	.	I	II	.	.	.	.	.	.	.	I	I	.
Polygonum longisetum	.	.	.	.	.	.	I	.	.	I	.	.	.	I	I	.	.	.	.	.	.	I	.	.	.	.	.	I	.	I	.	.
Phytolacca americana	.	.	.	.	.	.	I	.	.	II	.	.	.	I	II	.	.	.	.	.	II	II	.	.	.	.	.	I	.	II	.	.
14. Polygala japonica	.	III	r	.	.	.	II	I	II	I	.	.	I	.	I	.	III	.	.	.	.	.	IV	.	.	.	I	.	.	.	.	.
Calamagrostis arundinacea var. brachytricha	.	.	r	.	.	I	II	.	.	I	.	I	I	.	.	.	III	.	.	.	.	.	II	r	.	.	.	r	.	I	.	.
Patrinia scabiosaefolia	.	I	.	.	I	I	I	.	.	I	.	.	.	.	.	.	II	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.
Platycodon grandiflorum	.	.	r	.	I	II	I	.	.	I	.	I	.	.	.	.	II	I	.	.	.	.	II	.	.	.	II	.	.	.	.	.
Artemisia japonica	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	II	.	.	.	.	.	I	.	.	.	I	.	.	.	.	.
Chrysanthemum makinoi	.	.	r	.	.	.	II	.	II	I	I	.	.	.	.	.	II	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.
Aster scaber	.	I	.	.	.	I	I	.	.	I	.	.	.	.	.	.	I	.	1	.	.	.	I	r	II	.	II	r	.	.	.	I
Adenophora triphylla var. japonica	.	I	.	I	.	.	r	I	III	I	.	.	I	.	.	.	I	.	.	.	.	I	II	.	I	.	.	r	.	.	.	.
15. Vaccinium oldhamii	IV	V	III	II	II	II	III	II	IV	III	III	IV	V	IV	III	III	III	V	1	V	IV	III	IV	V	IV	3	III	IV	II	III	.	.
Pteridium aquilinum var. latiusculum	I	III	II	IV	III	III	IV	II	I	IV	III	IV	V	V	III	2	IV	IV	V	IV	IV	IV	2	V	I	II	III	.	.		
Miscanthus sinensis	V	V	V	V	V	V	V	V	IV	IV	V	V	V	V	V	3	V	V	V	V	IV	IV	3	V	II	III	V	r	r		
Lespedeza bicolor	IV	V	III	IV	V	IV	V	IV	IV	III	III	V	IV	IV	V	V	1	III	V	V	IV	III	IV	3	V	I	II	IV	.	.		
Amelanchier asiatica	I	I	IV	II	I	.	r	III	III	II	III	III	II	II	I	I	III	.	III	II	I	IV	III	III	II	3	II	I	III	I	r	r
Solidago virga-aurea var. asiatica	II	IV	III	II	III	IV	IV	IV	IV	IV	II	IV	II	I	V	V	V	I	2	III	II	III	V	II	III	.	IV	II	II	IV	.	I
16. Pinus densiflora	V	V	V	V	V	I	IV	V	V	IV	V	V	V	III	IV	IV	IV	V	3	V	IV	IV	V	V	V	1	IV	V	V	III	III	I
Quercus serrata	IV	V	III	IV	IV	IV	IV	V	V	V	IV	V	IV	V	IV	V	V	IV	3	V	V	V	IV	IV	IV	3	IV	IV	III	IV	I	I
Lyonia ovalifolia var. elliptica	V	V	V	V	V	V	V	V	V	III	V	V	V	V	V	V	V	V	3	V	V	V	V	V	IV	3	V	V	V	III	III	I
Rhododendron reticulatum	V	V	V	V	IV	V	III	V	V	II	V	V	V	III	V	IV	IV	V	3	V	IV	IV	V	V	V	1	IV	V	V	III	IV	.
Rhododendron kaempferi	V	V	IV	V	V	V	V	IV	V	V	V	V	V	V	IV	V	V	V	3	V	V	IV	V	V	IV	3	V	IV	IV	III	III	r
Castanea crenata	I	II	I	II	I	.	r	II	III	I	III	III	.	.	.	II	I	II	.	.	I	.	.	II	II	2	.	II	III	II	II	r
Pourthiaea villosa var. laevis	.	III	r	I	II	I	I	II	.	II	.	II	II	II	II	II	II	III	2	II	III	I	II	II	III	.	III	II	II	II	I	I
Viburnum wrightii	III	III	IV	I	III	II	III	II	V	II	IV	IV	IV	III	IV	IV	IV	IV	3	IV	IV	IV	IV	V	IV	2	V	IV	V	IV	I	I
17. Smilax china	IV	V	V	V	V	III	V	V	V	V	IV	IV	V	V	V	V	V	V	3	V	V	V	V	V	V	3	V	V	V	IV	IV	III
Rhus trichocarpa	IV	V	V	V	III	V	IV	V	V	V	V	V	III	V	V	V	V	V	3	V	V	V	V	V	V	3	V	V	V	V	V	II
Viburnum erosum	I	II	I	II	.	.	I	IV	III	II	II	II	I	.	I	I	II	I	1	III	II	IV	II	II	III	3	II	III	II	III	III	II
18. Cymbidium goeringii	I	.	II	I	I	I	I	III	I	I	III	IV	.	.	.	I	I	I	.	.	.	.	I	III	III	.	II	IV	III	II	V	II
Pertya scandens	.	I	I	.	.	II	I	I	II	.	III	IV	I	I	II	I	III	I	1	II	.	II	II	III	II	.	IV	III	III	II	II	II
Prunus jamasakura	I	I	.	I	I	.	I	II	III	II	II	IV	I	.	I	III	I	II	.	.	II	I	II	III	III	1	II	III	III	II	II	I
Quercus variabilis	III	.	I	.	.	I	II	I	I	II	III	III	I	II	.	I	r	II	.	I	I	II	II	I	II	1	.	II	II	II	I	I
Gleichenia japonica	I	I	.	I	I	.	I	.	I	II	I	I	I	.	I	I	I	II	.	II	II	I	.	II	I	.	.	II	II	.	II	r
Arundinaria pygmaea	II	I	I	.	.	I	II	.	.	II	III	II	I	.	.	III	III	II	1	I	II	III	III	III	IV	.	III	III	III	I	I	I
Platanthera minor	.	II	.	.	I	.	.	I	I	I	II	.	.	.	.	.	I	.	.	.	.	.	.	III	III	.	.	II	II	.	I	.

Note : System of enumeration numbers of the communities is different from that employed for the order Pinetalia densiflorae. r means the presence less than 5 %