

# DISTRIBUTION OF EVERGREEN AND SUMMERGREEN BROAD-LEAVED FOREST IN JAPAN\*

日本における常緑広葉樹林と夏緑広葉樹林の分布について

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## Synopsis

The purpose of the present paper is to describe the horizontal and vertical distribution of evergreen and summergreen broad-leaved forests in Japan. The evergreen broad-leaved forest, the characteristic vegetation of the Japanese Archipelago, is mostly coppice forest, i. e. secondary forest; the natural forest is hardly left intact. In addition the evergreen species increase in number, and the Eg-Quotient MIYAWAKI 1979 becomes higher in the vegetation of the evergreen broad-leaved forest in the lower latitudes. On the other hand, the natural deciduous forest still remains in northern Honshu and Hokkaido. The secondary deciduous forest, dominated by *Quercus serrata* or *Carpinus* spp., tends to extend itself not only in its original vegetation region, but also to some parts of the evergreen broad-leaved forest region.

## INTRODUCTION

The Japanese Archipelago is located at the eastern end of the Asian Continent, or the western end of the North Pacific Ocean. Its total land area is approximately 380,000 km<sup>2</sup>. 4 main islands and numerous smaller islands lie side by side from north (Lat. 45°33' North) to south (Lat. 20°56' North) in the shape of an arc. Over 95% of Japan's land was once covered with woods and forests. But it has been over 2,000 years since man began to inhabit the Archipelago, and by now, most of the natural forest has been destroyed with the expansion and sophistication of human activities. Most of the actual vegetation is "the secondary forest" and "the secondary grassland".

Abundant rainfall and humid warm climate make the East Asian region (the southern part of Japan, Korea and China, and the area as far as Himalaya) uniquely fit for the vegetation of Laurilignosa. Laurilignosa means the evergreen broad-leaved forest in Japan as opposed to Durilignosa in the Mediterranean area, etc.

This paper is concerned with the vegetation zones in Japan, vertical and horizontal distribution of Japanese forest and Eg-quotient of many forest vegetation in Japan.

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## VEGETATION ZONES IN JAPAN

From the phytosociological point of view, the vegetation of Japan can be classified into 4 major forest vegetation zones.

- 1) Alpine meadows and *Pinus pumila* dwarf forest community region on the highest mountain peaks, *i.e.* arctic alpine zone.

This region occupies only very small areas in Japan.

- 2) *Vaccinio-Piceetea japonicae* region on steep mountains reaching up into subalpine zone. Subalpine and subboreal conifer forests of *Abies* and *Tsuga* develop in this region.

- 3) *Fagetea crenatae* region on the hillsides and mountain areas and in the coastal plains of north Honshu and Hokkaido.

The forest in this region are deciduous forests, dominated by *Fagus crenata* and *Fagus japonica*, namely beech-forest with *Sasa* on the herb-layer. This type of beech forest is unique in the East Asian region.

- 4) *Camellieta japonicae* region in the lowlands or coastal regions except Hokkaido and north Honshu, *i.e.* evergreen broad-leaved forests.

The evergreen broad-leaved forest region can be subdivided into 4 subregions: *Quercion acuto-myrsinaefoliae* subregion (Inland section of Kanto and Kinki), *Maeso japonicae-Castanopsis* subregion (Shikoku, Kyushu and vicinity), *Psychotrio manillensis-Acerion oblongi* subregion (Habitat of limestones or rising coral on Ryukyu Islands), and *Psychotrio-Castanopsis sieboldii* subregion (non-limestone areas on Ryukyu Islands).

Human beings have long inhabited the evergreen broad-leaved forest region; it has been made into cities, farms, paddy fields and plantation forests. In Japan, 17 big cities out of 18 with the population of more than half a million are located within this region.

## VERTICAL DISTRIBUTION OF FOREST VEGETATION IN JAPAN

Most of Japan's land used to be covered with forest vegetation. Today, the potential natural vegetation is mostly forest vegetation, but the existing forest vegetation is either secondary or plantation forest and even these regions are limited in area.

Japan's natural and secondary forest vegetation is divided into 3 dominant types; evergreen broad-leaved forest type, summergreen broad-leaved forest type and conifer forest type. The Japanese Archipelago is more than 3,000 km long from north to south extends over many climate zones, *i.e.* from the subboreal climate to the subtropical climate. Therefore, the vertical distribution of forest vegetation is different from place to place. In this paper, the vertical distribution is studied in 7 region (prefecture or island) (Fig.1).

Forest vegetation of Okinawa Prefecture in the southern end of Japan, is mostly evergreen broad-leaved forest. In the area, of which the potential natural vegetation is evergreen broad-leaved forest, the secondary vegetation is evergreen broad-leaved forest dominated by *Castanopsis cuspidata* var. *sieboldii* or *Cinnamomum japonicum*. Summergreen broad-leaved

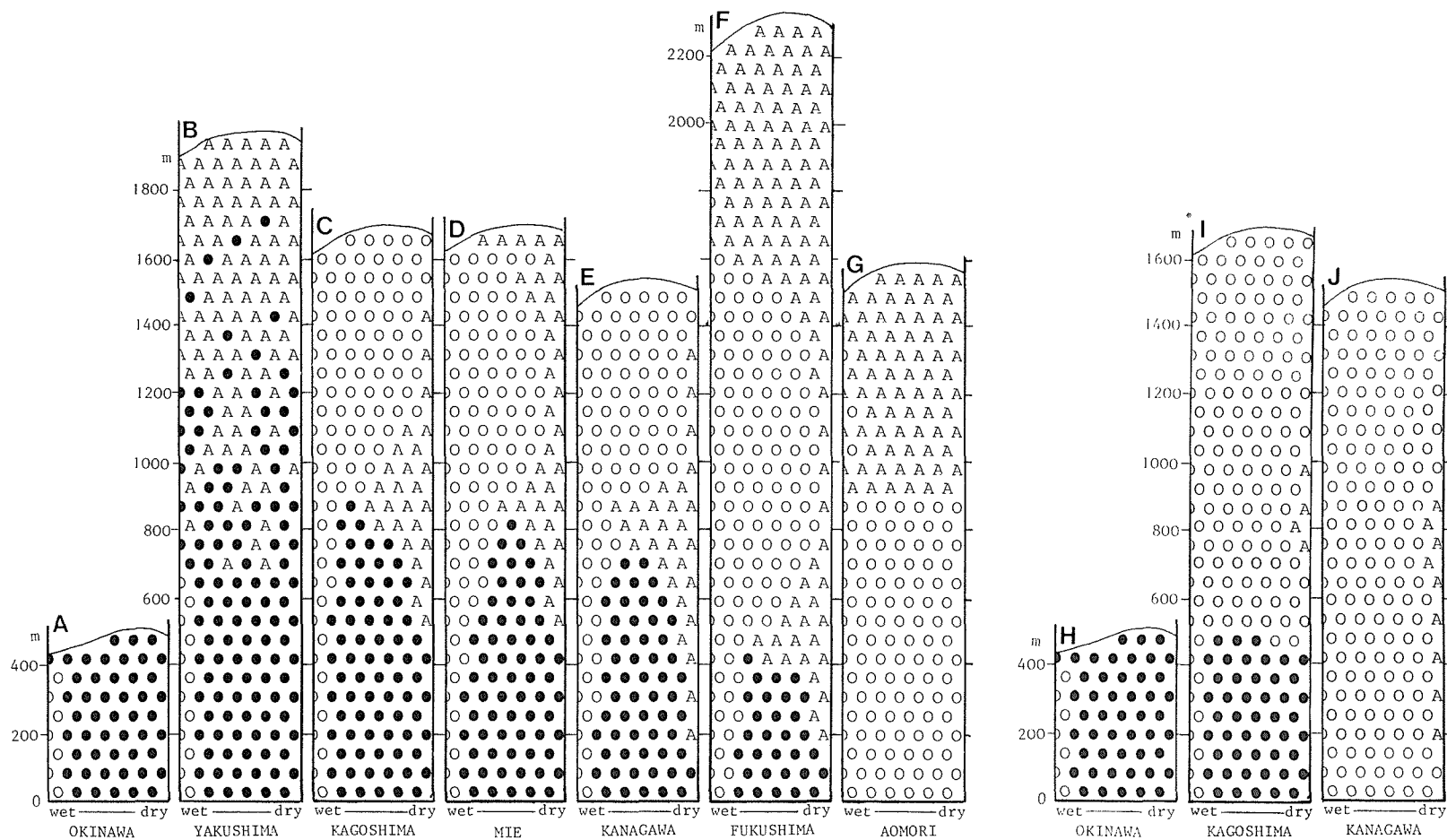


Fig. 1 Vertical distribution of forest vegetation in Japan

- evergreen broad-leaved forest
- summergreen broad-leaved forest
- A conifer forest

A-G : Natural forest  
 H-J : Secondary forest

forest in Okinawa Prefecture is limited only in unstable habitats such as riverside.

In Kagoshima Prefecture, which is located in southern Japan, evergreen broad-leaved forest of natural vegetation is distributed vertically upto 1,000 m and that of secondary vegetation is distributed upto ca. 450 m. Summergreen broad-leaved forest is secondary expanded into the *Camellietea japonicae* region. The conifer forest in Kagoshima Prefecture is mostly natural forest, dominated by *Abies firma*, on steep slope or peaks of mountains. The secondary conifer forest is mostly *Pinus densiflora*-forest, some of which is plantation forest.

In Kanagawa Prefecture, which is located in Central Japan, secondary forest of the *Camellietea japonicae*-region is summergreen broad-leaved forest dominated by *Quercus serrata*.

In Aomori Prefecture, which is located in the northern end of Honshu, the forest vegetation of *Fagetea crenatae*-region is mostly summergreen broad-leaved forest dominated by *Fagus crenata* or *Quercus mongolica* var. *grosseserrata*. Its upper limit is about 1,000 m.

## HORIZONTAL DISTRIBUTION OF THE EVERGREEN BROAD-LEAVED FOREST

As to the potential natural vegetation, the evergreen broad-leaved forest is distributed in southern Tohoku and down south along coastal areas as shown in Map 1. Map 2 shows the distribution of actual vegetation of the evergreen broad-leaved forest. The black part indicates the natural vegetation.

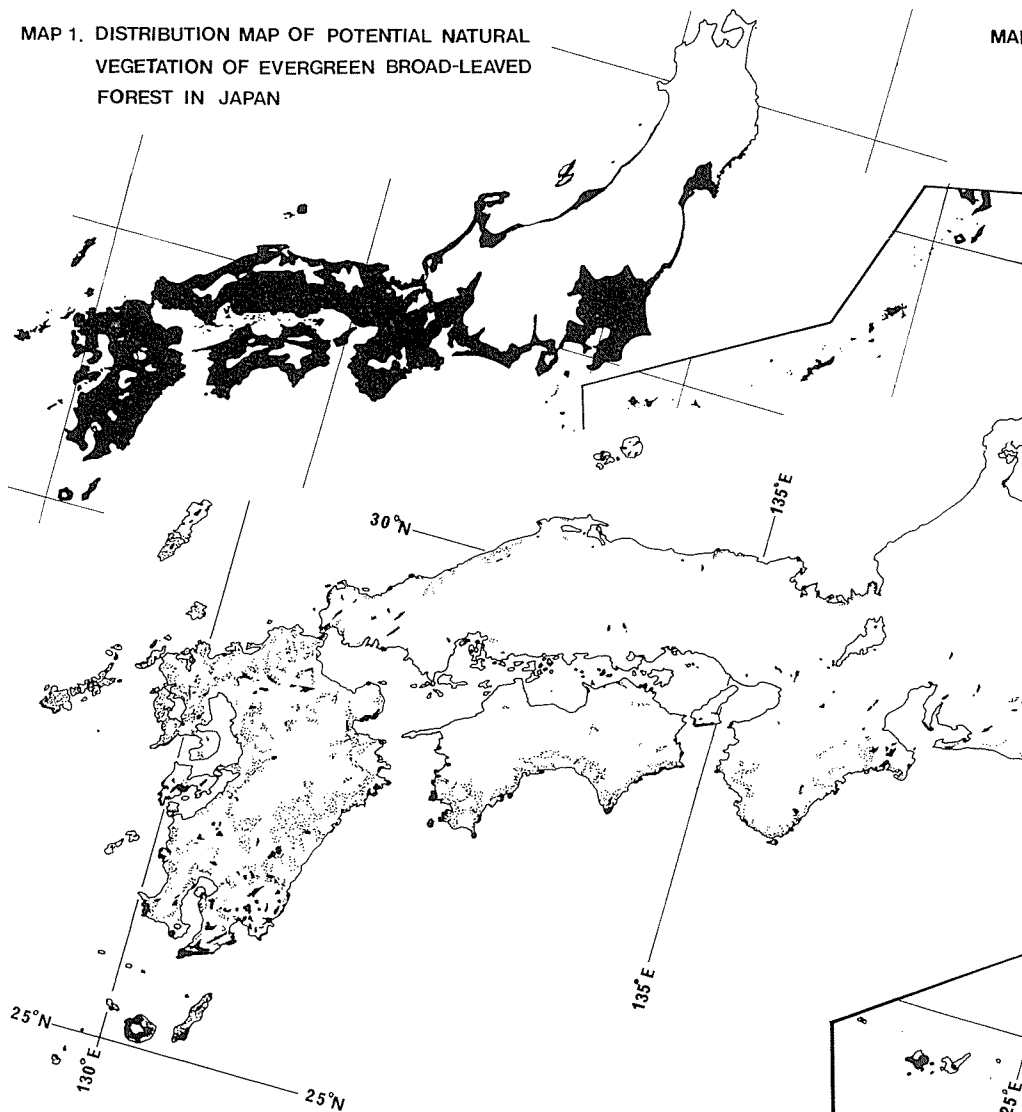
Maps 1-4 are based upon the potential natural vegetation map by Miyawaki et al. 1978, the actual vegetation map (ed. by the Environment Agency (Kankyo-cho), 1976), and the present writer's own field surveys.

In Map 1~2, Its representative vegetation includes associations of *Hydrangeo-Castanopsietum sieboldii* and *Distylo-Quercetum salicinae* in Yakushima Island, *Symplocoglaucae-Castanopsietum sieboldii* in Kyushu, and *Quercetum myrsinaefolae* in Kanto. They all consist of trees of 20-30 m high, and component species are mostly evergreen species. The natural vegetation of the evergreen broad-leaved forest remains in very small areas. The dotted area shows the distribution of the secondary or substitutional evergreen broad-leaved forest, medium-height forest and the shrub of 8-15 m in height. The coppice forest or shrub develops the habitat of which natural forest is cut down. This vegetation stays the same as long as human interference is made periodically.

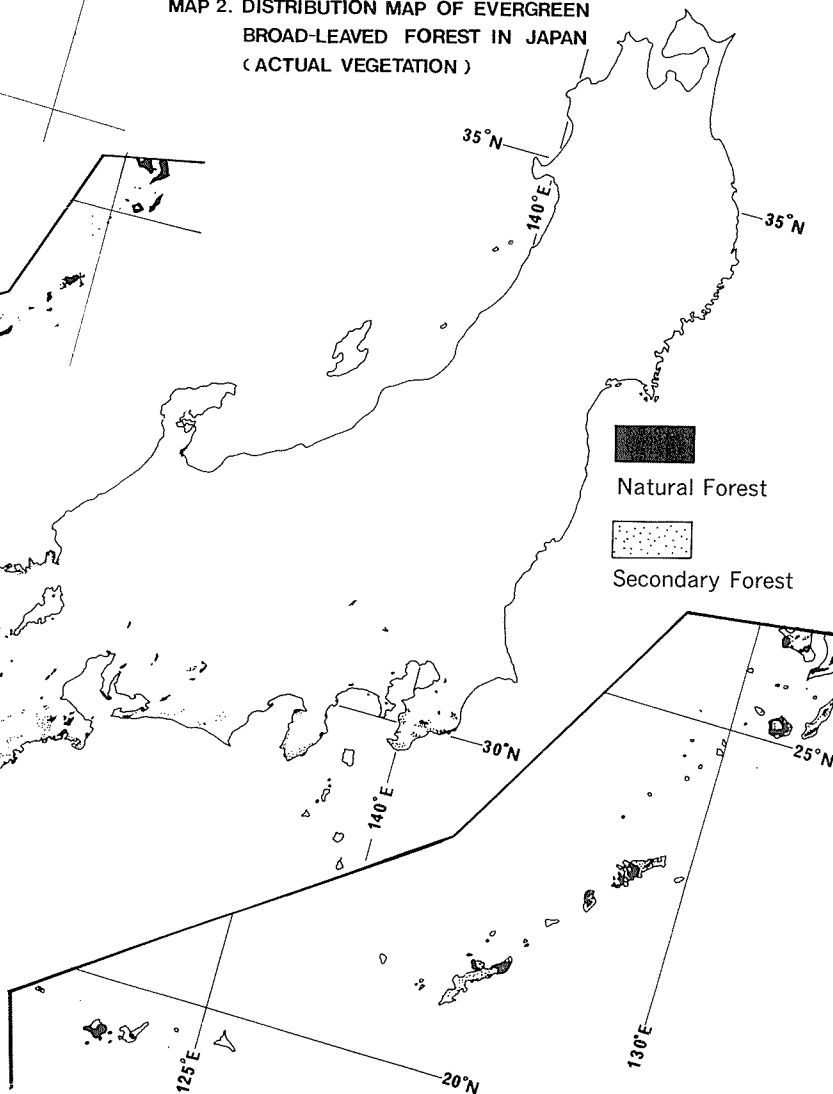
The evergreen coppice forest is extended in relatively warm lowlands. The latitude of 35.5°N is its northern limit.

The evergreen coppice forest is dominated by *Quercus glauca*, *Pasania edulis*, *Castanopsis cuspidata* etc., and can be summarized into *Tarenno-Castanopsietum*, *Viburno-Pasanietum edulis* and *Ilex rotundifolia-Quercus glauca*-community. In other word, the development of the secondary forest of the evergreen broad-leaved forest is limited to only limited parts of the evergreen broad-leaved forest region or *Camelli-*

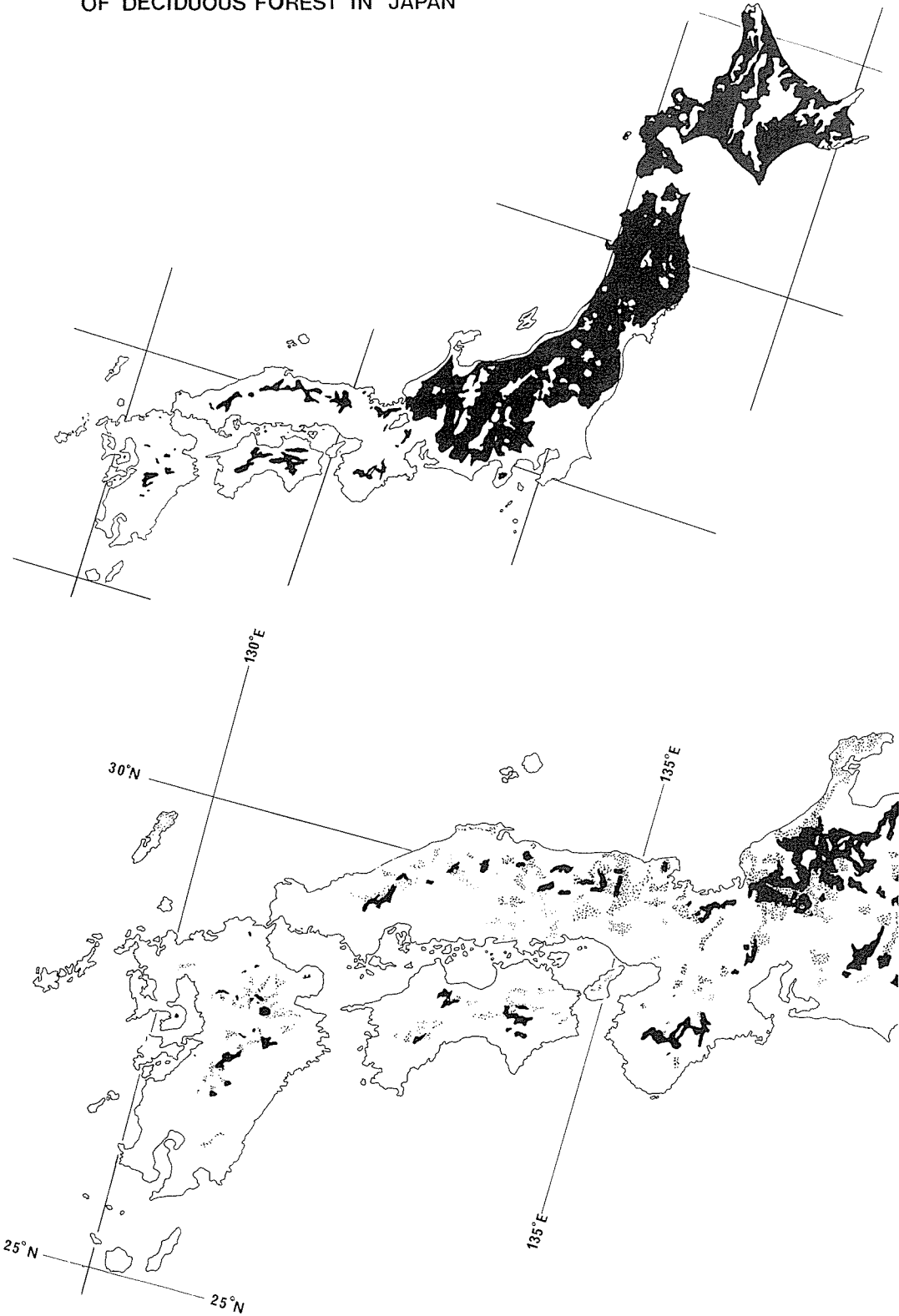
MAP 1. DISTRIBUTION MAP OF POTENTIAL NATURAL VEGETATION OF EVERGREEN BROAD-LEAVED FOREST IN JAPAN



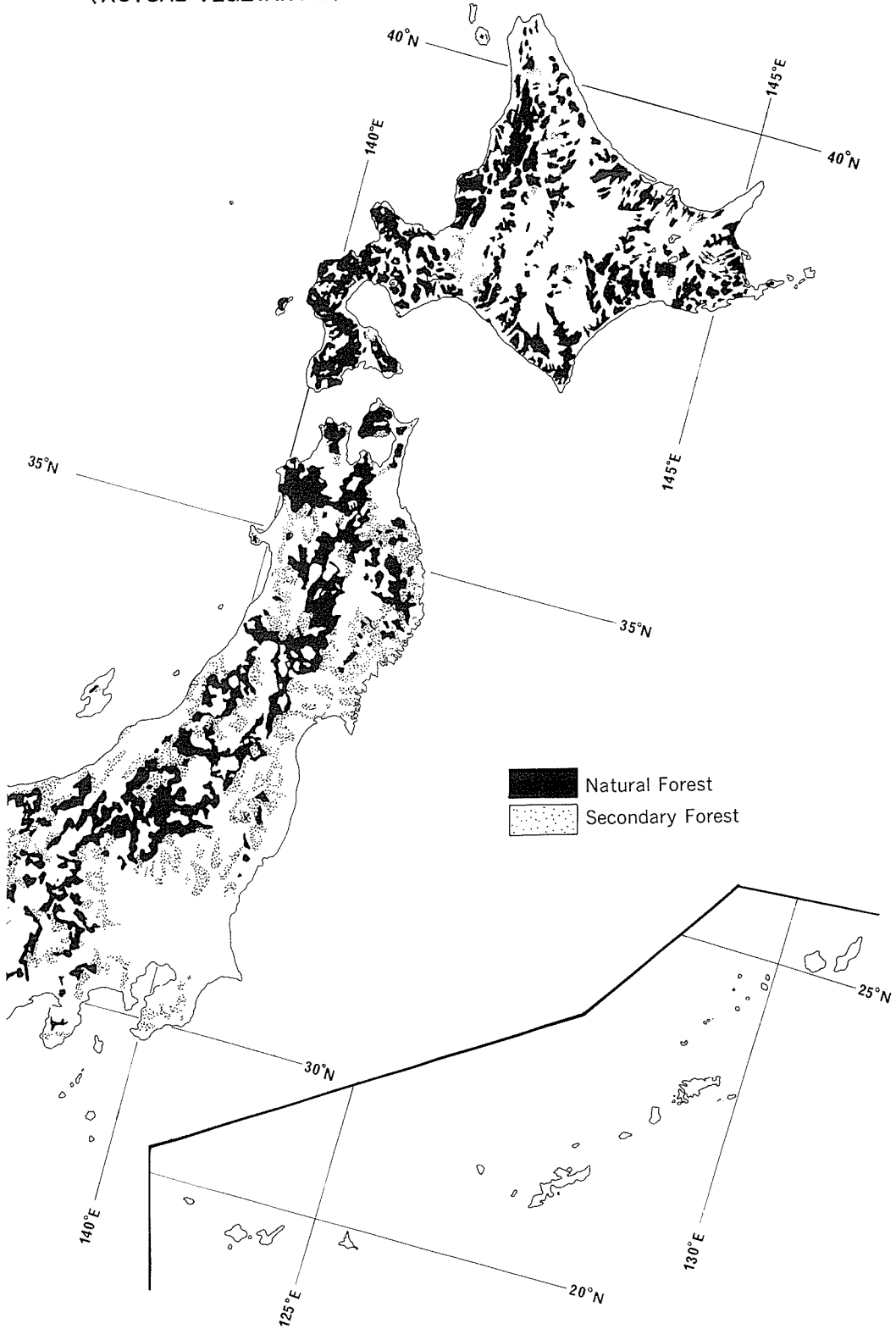
MAP 2. DISTRIBUTION MAP OF EVERGREEN BROAD-LEAVED FOREST IN JAPAN (ACTUAL VEGETATION)

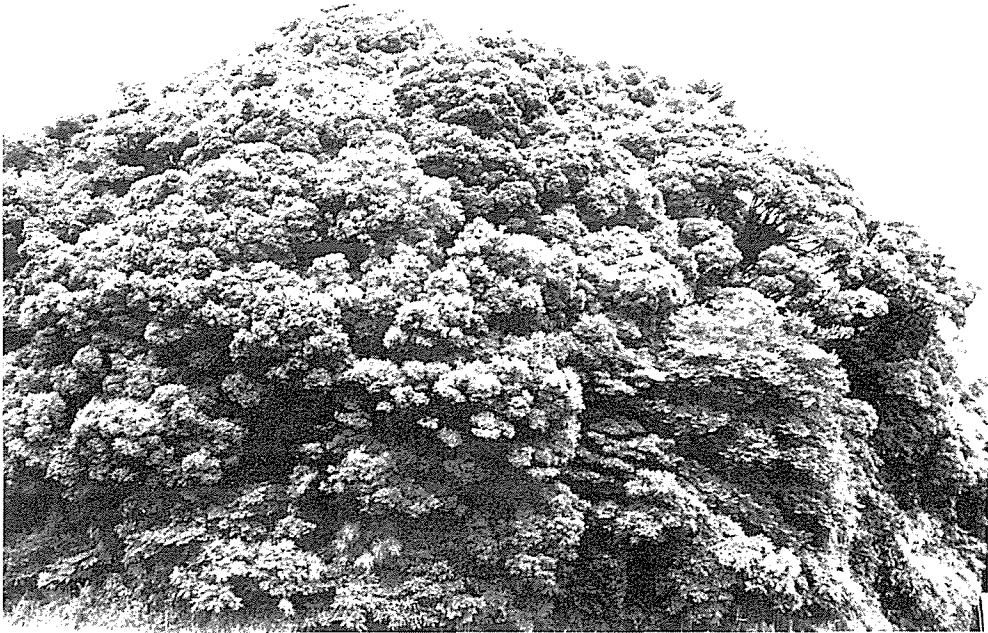


MAP 3 . DISTRIBUTION MAP OF POTENTIAL NATURAL VEGETATION  
OF DECIDUOUS FOREST IN JAPAN

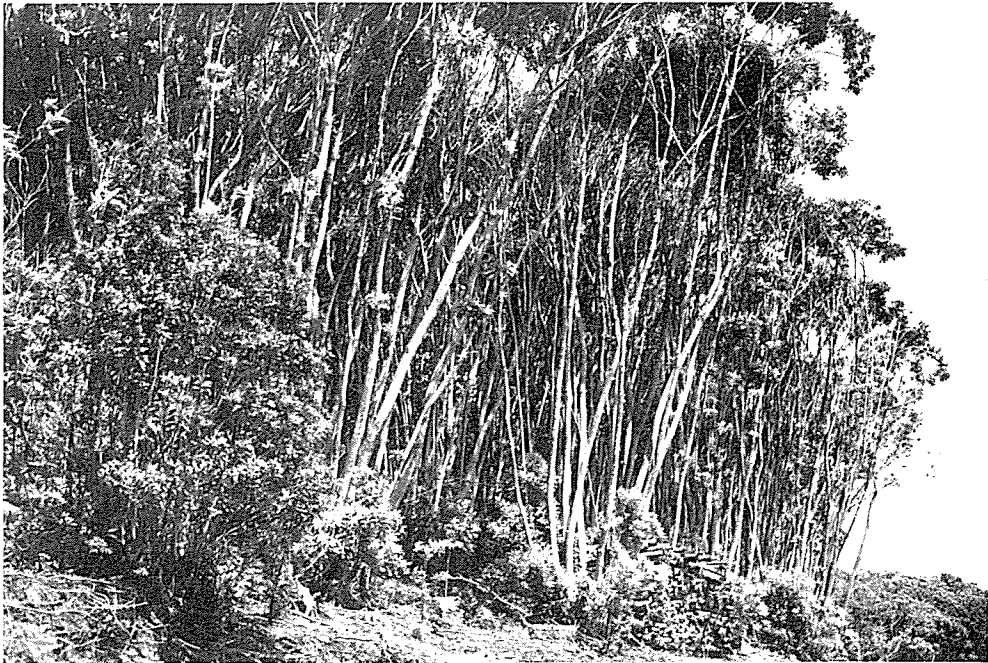


MAP 4. DISTRIBUTION MAP OF DECIDUOUS FOREST IN JAPAN  
(ACTUAL VEGETATION)





**Photo 1.** Natural evergreen broad-leaved forest in N-Kyushu  
(*Symploco glaucae*-*Castanopsietum sieboldii*).



**Photo 2.** Secondary evergreen broad-leaved forest in N-Kyushu (*Viburno*-*Pasanietum*).





Photo 3. Natural deciduous forest in N-Honshu (*Aucubo-Fagetum crenatae*).



Photo 4. Secondary deciduous forest in Central-Honshu (*Castaneo-Quercetum serratae*).

*etea japonicae*-region. Map 2. shows the relationship between the natural evergreen broad-leaved forest and its secondary vegetation in Japan. The natural vegetation of the evergreen broad-leaved forest retrogressively shift first to secondary forest, then to secondary shrub and to secondary grassland in succession as human interference continues.

The secondary forest of the evergreen broad-leaved forest may be roughly divided into 3 types ; evergreen broad-leaved forest type, deciduous forest type and *Pinus* forest type. The secondary forest retrogresses to the evergreen medium-height forest and shrub such as *Tarenno-Castanopsietum*. In contrast, in Kanto and Tokai, northern part of the evergreen broad-leaved forest region as of *Quercus serrata*-develops. In the Seto Inland Sea district where rainfall is extremely small, the natural vegetation, once destroyed cannot recover itself so easily. The secondary forest there is the Pine forest ; that is *Rhododendro-Pinetum kinkianum*. When excessive human impact is applied, it becomes the summergreen broad-leaved shrub with *Mallotus*, *Rhus* as one of its major component species. At the southern end of the Japanese Archipelago, *e. g.* Okinawa and south islands, the formation of this summergreen broad-leaved shrub is limited. It appears relatively soon after deforestation, or as a secondary forest in a site where habitat is rather unstable. Moreover, the deciduous forest has many component species that are evergreen plants.

In other words, the formation of the deciduous secondary forest is induced by relatively slight human impact in highlands and northern part of the evergreen broad-leaved forest

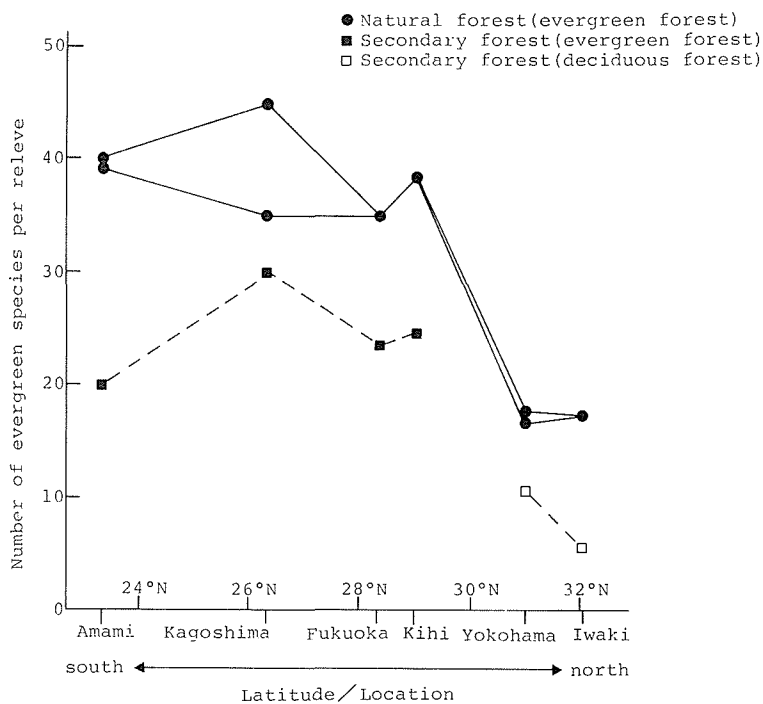


Fig. 2 Number of evergreen species in the evergreen broad-leaved and deciduous forests.

region. In lowlands and southern part of the same region, however, the evergreen broad-leaved forest is able to regenerate the secondary forest though coppice, even if rather heavy impact is applied. It may be said in this connection that the summergreen *Quercus* species, a major component species of the deciduous secondary forest, is distributed only as far as Kyushu. It does not exist on Ryukyu Islands.

The spread of the deciduous forest in Japan is shown in Map 4. The expanse of the actual vegetation of the deciduous forest is larger than that of the evergreen broad-leaved forest.

The black indicates the natural deciduous vegetation area, e.g. *Aucubo-Fagetum crenatae*, *Corno-Fagetum crenatae*, etc.

The dotted area shows the secondary forest. It is clear from this map that the deciduous forest covers not only potential natural area of deciduous forest region, but also the evergreen broad-leaved forest.

### EG-QUOTIENT

Fig. 2. shows the total number of evergreen species in each evergreen broad-leaved forest. The vertical axis indicates the number of appearing species, and the latitudinal axis shows the sites of investigation in relation to the latitude. The component species of the evergreen broad-leaved forest include *Aucuba japonica*, *Eurya japonica* and *Cinnamomum japonicum*

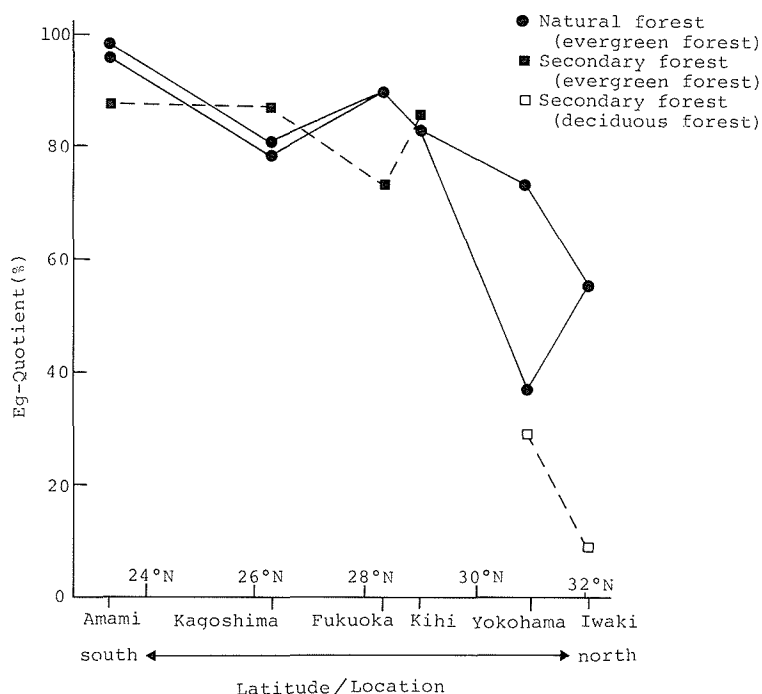


Fig. 3 Change of Eg-Quotient in the evergreen broad-leaved and deciduous forests in Japan.

which may be summarized into the character and differential species of class (*Camellia japonica*), namely, the species which are constantly found in almost all evergreen broad-leaved forest, as well as species represented by *Actinodaphne longifolia*, *Quercus gilva*, *Symplocos glauca* and *S. prunifolia* which grow only in special vegetation units.

In Japan, the lower the latitude, the more abundant and diverse the evergreen species that constitute each forest vegetation. The evergreen broad-leaved forest in Kagoshima and Amami Island has about 40 evergreen species per vegetation quadrat while the evergreen broad-leaved forest in Yokohama or Iwaki has less than 20 species. The flora tends to follow suit. There are many component species in the evergreen broad-leaved forests which is distributed only as far as Kyushu. But, evergreen species which distribute on northern Japan are very rare.

The natural vegetation of such evergreen shrub as of *Quercus* and *Litsea* can be found in coastal regions which is directly exposed to strong prevalent winds. The total number of appearing species in the *Quercus phillyraeoides*-forest (*Pittosporo-Quercetum phillyraeoidis*), is 15-30, which is less than that of the tall tree forest. Out of this 15-30, the number of evergreen species is a little over 10 in the large area from Kagoshima to Yokohama, with the exception of *Litsea*-forest in Amami where the average is 21.

In terms of species composition, the summergreen species in the evergreen broad-leaved forest tend increase i) as the climate becomes colder, ii) as the human interference increases. Therefore, from the ratio of evergreen species in a given vegetation, *i. e.* Eg-Quotient (Miyawaki 1979), one can judge the level of stability of the habitat which supports the vegetation, and the degree of development of vegetation in the natural evergreen broad-leaved forest. Fig. 3 shows the Eg-Quotient of each community in representative region.

In Amami, the Eg-Quotient of *Castanopsis*-Forest (*Lasiantho-Castanopsietum sieboldii*) is over 90%, and the Eg-Quotient of its secondary forest, *Quercus-Castanopsis*-Forest (*Tarenno-Castanopsietum sieboldii*) is 86%. They are both evergreen broad-leaved forest. In Yokohama, the Eg-Quotient of *Quercetum myrsinacefoliae*, natural evergreen broad-leaved forest, is 38 to 76%, and the Eg-Quotient of its secondary forest, *Quercetum acutissimo-serratae* (deciduous forest) is only 32%.

It may be said, therefore, that the lower the latitude, the higher the Eg-Quotient of the forest. Within the same evergreen broad-leaved forest region the secondary forest is evergreen broad-leaved forest with the Eg-Quotient over 80% on Amami to Kihii in the north. On the other hand, in northern Yokohama, the secondary forest is deciduous forest with the Eg-Quotient of only 32%.

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### 摘 要

南北 3,000 km に及ぶ日本列島の大部分は、かつて森林植生に被われており、現在でも潜在自然植生はスグジイ、タブノキ、シラカシなど常緑広葉樹林およびブナを中心とする夏緑広葉樹林で占められている。しかし、ながい間にわたる人間活動による直接・間接の影響の結果として自然林の多くは破壊しつくされ、現存する森林植生の多くは二次林、代償植生にかえられてしまっている。本報において、日本列島に現存して

いる常緑広葉樹林および夏緑広葉樹林の分布が、自然林と二次林とに分けて、考察されている。

同時に、常緑植物の出現種数および日本列島の7地域を対象とし常緑広葉樹林および夏緑広葉樹林における Eg 率 (Miyawaki 1979) について比較検討を行っている。同じ常緑広葉樹林でも北に位置している横浜やいわきの林分では常緑植物の出現種数が各植分あたり 20 種以下となり、Eg 率も 80 % 以下となっている。

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