(2) Nature in Japan

2-4) Amphibians and Reptiles

a) Amphibians and Reptiles of Japan

Eighty-four kinds (species and subspecies) of reptiles and fifty-eight kinds of amphibians are known in Japan. The amphibians can be subdivided into two orders: urodeles (19) and anurans (39). The figures in parenthesis give the number of species and subspecies. The reptiles can be subdivided into three categories: turtles (10; including 5 marine species), lizards (32) and snakes (42; including 9 marine species).

b) Characteristic Species

The abundance of salamander species is the prime characteristic of the Japanese herpetofauna. It is well known that the world's largest living amphibian, the Japanese giant salamander, *Andrias japonicus*, inhabits this country, but there are many other interesting salamanders as well. They are hynobiid salamanders. Speciation of this most primitive family of urodeles is noteworthy in Japan, and may be due to the complicated landscape. It is supposed that the mountain chains isolated the populations of these slow-moving animals, so that speciation occurred. Isolation of the Japanese Islands from the Eurasian continent occurred a long time ago, and it prevented more progressive competitors from invading Japan. This may be the reason why the primitive animals survived till the present time. They hynobiids arose in the eastern Eurasian continent and invaded Japan through the Korean peninsular or East China Sea. One may think that more species of the salamanders would inhabit their original home, but fewer are known in China than in Japan. Comparison between Japan and China reasserts the distinctiveness of the hynobiid fauna. The hynobiids are a unique family among herptiles that contains more species in Japan than on the continent. Ancestral hynobiids invaded Japan and differentiated into a number of species and subspecies on their way north, and finally reached Hokkaido. This assumption is supported by the morphological features of *Hynobius retardatus* which is distributed in Hokkaido.

Among the Salientia, *Babina* (Assasin Frogs), which are endemic to Amami and Ryukyus, are of special importance. This area belongs to an old geographic era and preserves many relic animals.

Endemic species of other amphibia and reptile of this area include *Tylotoriton andersoni* and *Geoemyda spengleri japonica* which are also relict. *Trimeresurus* spp. and *Eumeces* spp. also accomplished a unique evolution here.

Among the Salientia of mainland, it is of special interest from an evolutional standpoint that *Rana brevipoda porosa* appeared as the result of crossing between *R. brevipoda* and

R.nigromaculata. The evolution of *Bufo torrenticola*, a species living in torrents, in the mountain ranges of central Japan may be related to geological history. Three frogs, *Rhacophorus* spp., generally lay eggs in trees, but *Rhacophorus schlegeli* lays its eggs on the ground. This is assumed to be one of the types of adaptation to the north and is considered an example of evolution in the struggle against a cold environment.

c) Endemic Species and Evolution

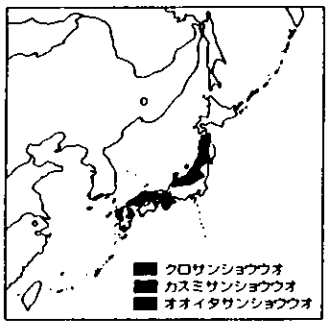
The lizards and snakes in mainland Japan including Hokkaido are mostly endemic species. They are supposed to have invaded Japan through the Korean Peninsula and evolved uniquely. Hokkaido and the southern Kurils are assumed to have been connected in that time and have many animals in common. Perhaps the Tsugaru Strait did not exist at that time but the Soya Strait did. It is supposed that the Korean Peninsular is the origin of progenitor types because many living *Takydromus* and *Agkistrodon* are found there. Many of the species, which live in Honshu, Shikoku, and Kyushu but not in Hokkaido, are also found on the Continent. Their absence is not due to climatic factors, because they are distributed much farther north on the Continent.

Those which came from the Continent through Taiwan and the Ryukyu Archipelago are *Buergeria japonica*, *Microphyla ornata*, *Japanulus plygonata*, *Takydromus smaragdinus*, and *Opheodrys* spp., etc. On this route, the amphibians and reptiles of Sakishima are rather close to those in southern China and Taiwan, and endemicity is less conspicuous than in the Ryukyu Archipelago.

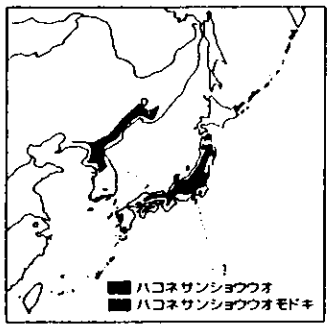
千石 正一（1982）：**日本の両生類･爬虫類、日本の自然環境、 環境庁**

(2) Nature in Japan 2-4) Amphibians and Reptiles

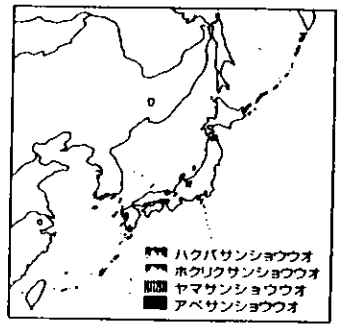
Distribution of Salamander



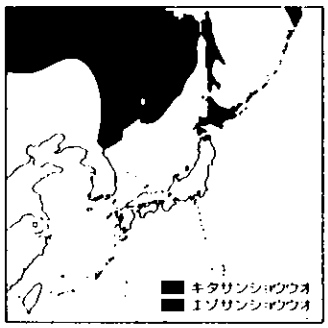
Japanese black salamander, *Hynobius nigrescens*
Clouded salamander, *Hynobius nebulosus*
: Oita salamander, *Hynobius dunni*



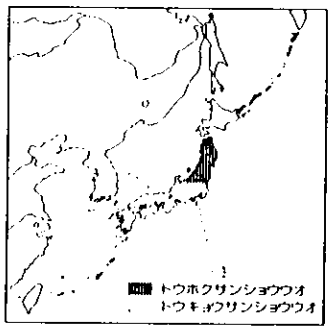
Japanese clawed salamander,
Onychodactylus japonicus
Onychodactylus fischeri



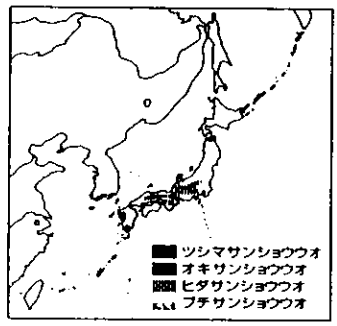
Hakuba salamander, *Hynobius hidamontanus*
Hokuriku salamander, *Hynobius takedai*
Japanese mountain salamander, *Hynobius tenuis*
Abe's salamander, *Hynobius abei*



Siberian salamander, *Salamandrella keyserlingii*
Hokkaido (Yezo) salamander, *Hynobius retardatus*

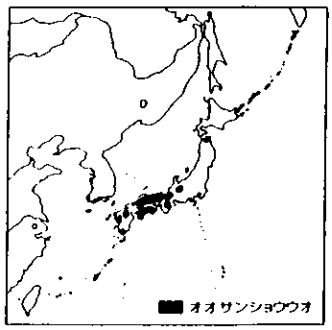


Tohoku salamander, *Hynobius lichenatus*
Tokyo salamander, *Hynobius tokyoensis*



Tsushima salamander, *Hynobius tsuensis*
Oki salamander, *Hynobius okiensis*
Hida salamander, *Hynobius kimurae*
Spotted salamander, *Hynobius naevius*

Amber-colored salamander, *Hynobius stejnegeri*
Odaigahara salamander, *Hynobius boulengeri*



Japanese giant salamander, *Andrias japonicus*

松井 正文 (1996) 両生類総論、日本動物大百科 第 5 巻 両生類・爬虫類・軟骨魚類 (日高 敏隆 監修). 平凡社

(2) Nature in Japan

2-5) Insects

a) Diversity of Insect Fauna

Japan is noted for the diversity of its insect fauna. How many insect species can be found there, has never been answered with certainty. It was about 200 hundred years ago that Carol von Linne started the naming of living organisms, and only about one hundred years have elapsed since Japan opened its gates to modern biological science. This means that Japanese systematic biology still remains somewhat behind that of western countries.

However, we may attempt to estimate roughly the number of insect species found in Japan. In 1945 Kloet and Hincks published a book in which all the known British insects were listed, about 20,000 species. There may be some subsequent additions to the exact number, but we can compare the species number between the two countries with well-surveyed insect groups. Today, 58 species of butterflies and 43 species of dragonflies are known from the British islands, and 225 and 189 form the Japanese island. From this ration we can roughly that Japan has four or five times more insect species than Britain.

b) Plyletic Classification of Insects

We regret we have no compete list of Japanese insects which might reach about 100,000 and probably only about 10,000 species have been illustrated in books published in Japan.

We have a considerable number of very interesting and important insect species from the systematic point of view. They are a number of strictly endemic Japanese species and endemic, but commoner, East Asiatic species.

As an example of the former category we can mention Epiophlebiid dragonflies, a relic insect group represented by one species in Japan and another species in the Himalayas. Another archaic dragonfly, *Tanypteryx pryeri*, is a member of ten species surviving in the circum-Pacific area. A most primitive Orthopterous insect group, the Grylloblattodea, the representatives of which are subterranean, are found in Rocky Mountains and several scattered areas in the Far East, i.e., South Ussuri, Korea and the four large islands of Japan. These three groups of insects are recognised as the survivors (relics) from past ages.

As examples of widely ranging East Asiatic insects it is not appropriate to mention *Papilio xuthus* or *Pieris rapae*, but we may mention *Sasakia charonda*, two *Luehdorfia* species (*L.japonica* and *L.Puziloi*), *Lethocerus deyrolli*, together with *Terpnosia vacua*, and *Luciola cruciata*. These six Asiatic species have common or very close kin in continental Asia. *Nannophya pygmaea* is a tropical species extending from Southeast Asia to Japan, and its northernmost habitat is the northern end of the mainland of Japan.

The migratory insects visiting Japan, and quite often becoming established in Japan, are not interesting from a faunal viewpoint, but they include ver common insects and a number of extremely serious pests to Japanese agriculture.

c) Natural Habitats of Insects

In order to briefly study the natural habitats of Japanese insects we shall consider the above-mentioned insects as examples. As an example of low mountain insects we have the two *Luehdorfia* butterflies whose larvae are exclusively limited to *Asarum* plants (Aristorochiaceae). As lowland or plain insects we have *Terpnosia vacua*, *Sasaki charonda*, and many others. As for aquatic insects, the larvae of *Epiophlebia superstes* dwell in mountain cascades, the larvae of *Tanyptery pryeri* dwell in valleys with seepage water, *and Luciola cruciata* lives in clear running water on hillsides. *Lethocerus deyrollei* dwells in old lowland ponds and *Nannophya pygmaea* is confined to sphagnum swamps.

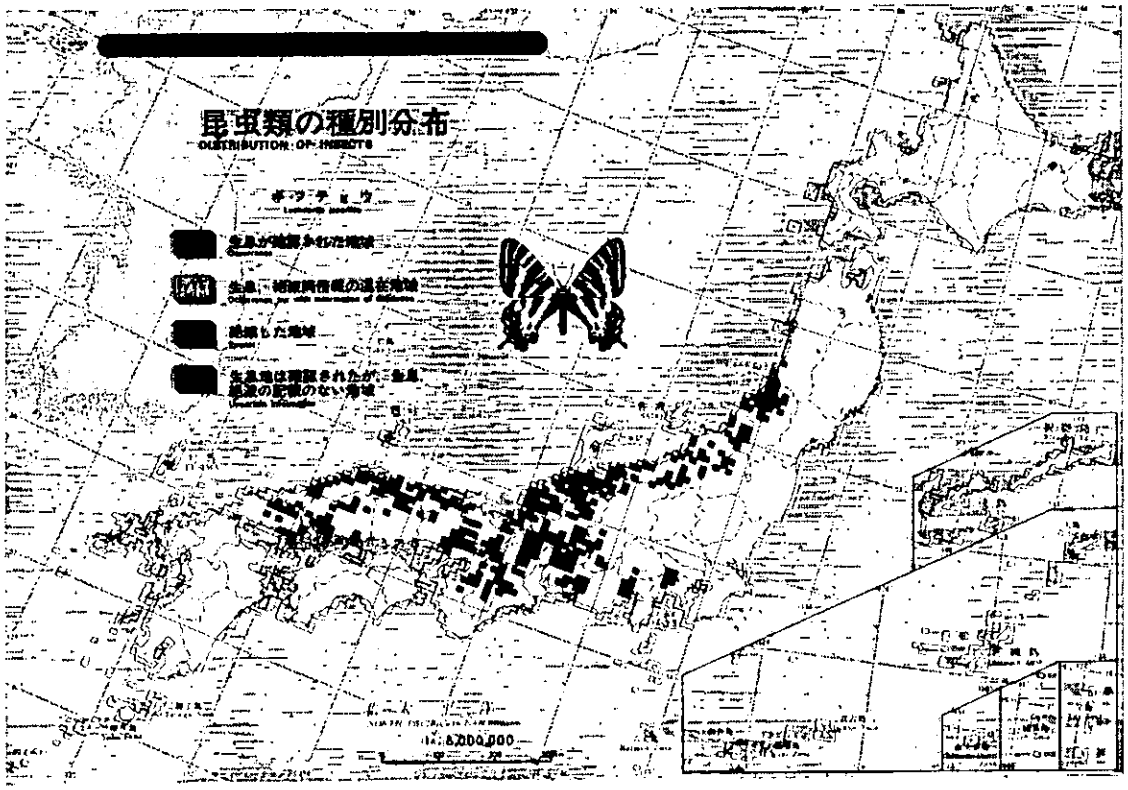
These insects which we have selected as examples can be treated as index species representing each particular environmental condition. In other words, the existence of any of these insects species indicates the presence of a particular natural environment.

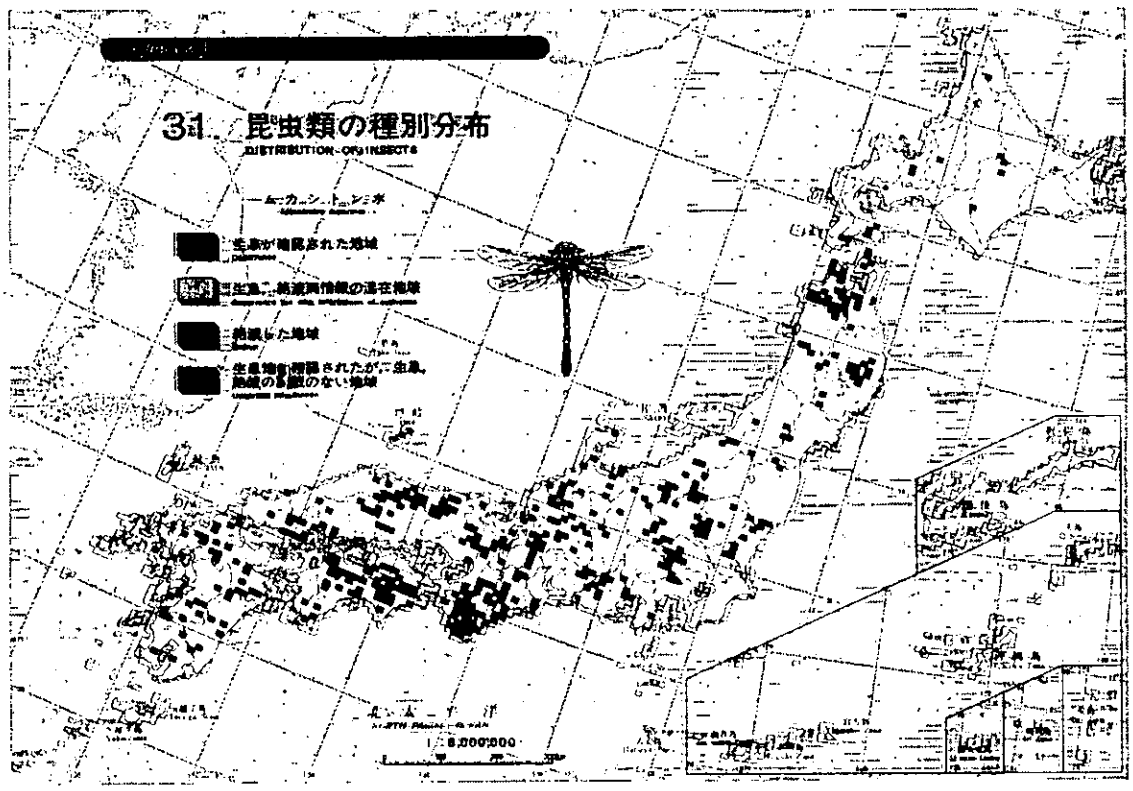
The butterfly species here mentioned tell of the presence of particular food-plants and their surrounding environment; aquatic dragonfly larvae, water-bugs, and firefly larvae denote respective limnological conditions. The subterranean Grylloblatids will be an indicator of a particular terrestrial constitution.

It should not be forgotten, however, that these insect species are basically subject to internal control, which may be influenced by environmental factors including the pressure of competitors.

朝比奈 正二郎（1982）： **日本の昆虫類、 日本の自然環境、 環境庁**

(2) Nature in Japan 2-5) Insects





日本の昆虫類、日本の自然環境、環境庁

(2) Nature in Japan

2-6) Plants

a) Forests of Japan

Because of the abundant precipitation in all seasons, Japanese vegetation is basically forest. Since Japan is located at medium latitude, the area where plants do not grow due to low temperature is limited to the top of the higher mountains in Honshu and Hokkaido.

Though a small country, the Japanese Archipelago is greatly extended from north to south and the difference of temperature by area is great; the mean annual temperature ranges between 2℃ and 22℃. In spite of the small which of the islands, there are high Japan is located between the Asian Continent and the Pacific Ocean, the influence of the monsoon is so great that the difference in temperature between summer and winter is great. Under this temperature regime, a variety of forest vegetation grows; there are laurel forests (evergreen broad-leaved forests), summer-green broad-leaved forests and evergreen coniferous forests. Further, because of the complicated topography and geological formations and the many volcanoes, local variation in soil is also great, and the variety of soil conditions in turn produce a diversity of plant communities.

b) Flora of Japan

The number of plant species that make up plant communities is also great. In Hokkaido, Honshu, Shikoku and Kyushu there are ca. 4,000 species of seed plants belonging to 900 genera, and 400 species of ferns, and in the Ryukyu Archipelago there are ca.1, 500 species of seed plants and 250 species of ferns. In the Bonin Islands 180 species of seed plants and 80 species of ferns are known, of which 107 and 20 species, respectively, are endemic. The species composition of the Ryukyu Archipelago and the Bonin Islands belongs to the Continental Southeast Asiatic Region, and that of the four main islands belongs to the Sino-Japanese Region. The four main islands are divided into four districts, Hokkaido, the Japan Sea district, the Pacific district, and Central Mountain district, on the basis of the climatic factors and vegetation.

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c) Comparison with Other Areas

Japanese flora is notably more diversified than that of other areas at a similar latitude, such as New Zealand and the northeastern part of North America. The British Isles for example, has only about 1,500 species of higher plants, while Ireland has about 1,000 species; although these areas are located in higher latitude than Japan. Generally, the reasons for this high diversity in Japanese flora are as follows:

- Wide range of temperature differences along the north-south axis of the archipelago;
- Steep mountainous areas of high altitude (over 3,000 m);
- The peculiarities of Japan's regional geological history.

There are no high mountains in southern Japan, which was once connected the tropical part of Asia, and the whole archipelago straddles the climatic boundary between the temperate and tropical zones. Over time, climatic changes moved this boundary moved up and down the north-south axis of the archipelago. During the glacial periods when the flora and fauna of northern Europe and America were repeatedly devastated, the plants and animals avoided extinction by moving south along the length of the archipelago to warmer areas. Japan is also has had the additional good fortune of being surrounded by the sea, and none of these climatic fluctuations in its history have ever brought a dry period to Japan. For all these reasons the flora and fauna has been able to survive, evolve and diversify to a much larger extent than that of northern Europe and America.

Japanese Flora / Comparison with Other Similar Regions of the World

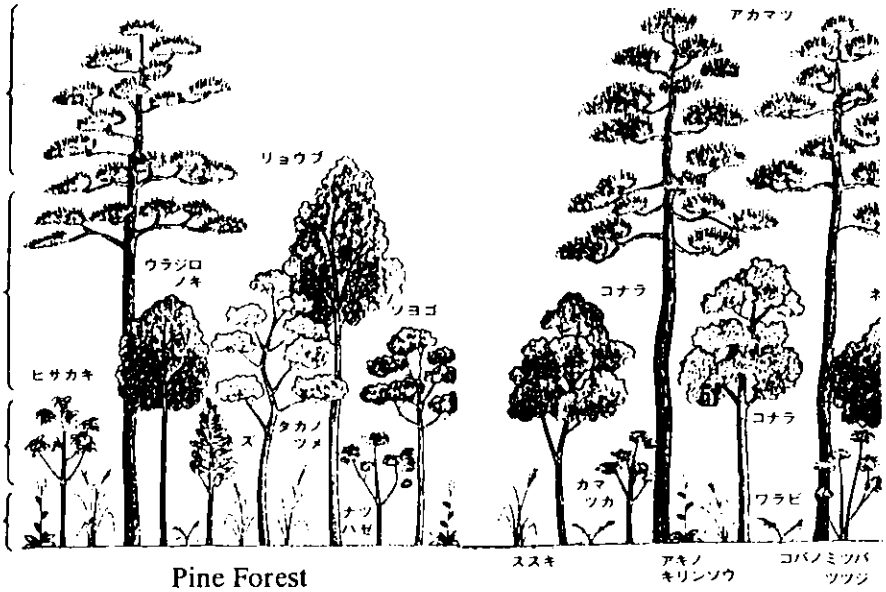
Genus/Species	Pteridophytes,	Gymnosperms,	Dicotyledones,	Monocotyledones,	Latitude
Japan	81/401	17/39	737/2353	275/1064	30-45.5 (N.Lat.)
North-eastern region of North America	32/108	10/26	438/1727	178/974	36.5-48 (N.Lat.)
New Zealand	47/164	5/20	233/11249	115/438	34-47.5 (S.Lat.)

佐藤 大七郎（1982）：**日本の植物、 日本の自然環境、 環境庁**
堀越 増興 他 編（1996）：**日本の自然 6 日本の生物、 岩波書店**
前川 文夫 (1977)：**日本の植物区系、玉川大学出版局**

(2) Nature in Japan 2-6) Plants (1)

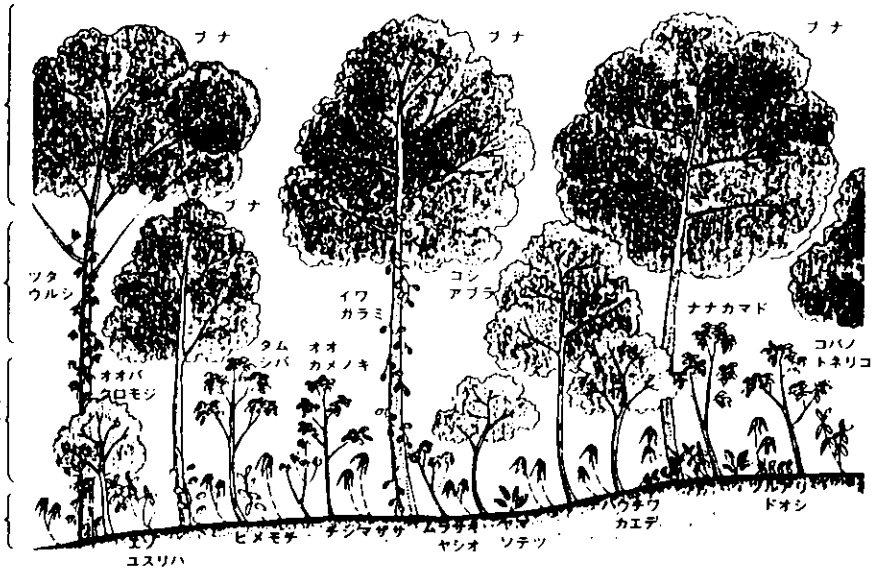
Typical Forest Types in Japan (1)

- Tree Layer
  Pinus densiflora
- Sub-tree Layer
  Clethra barbinervis,
  Sorbus japonica,
  Ilex pedunculosa,
  Evodiopanax innovans
- Shrub Layer
  Eurya japonica,
  Vaccinium oldhamii
- Herb Layer



Pine Forest

- Tree Layer
  Fagus crenata
- Sub-tree Layer
  Fagus crenata,
  Acanthoanax sciadophylloides,
- Shrub Layer
  Lindera umbellata,
  Mognolia solicifolia,
  Vivrnum dilatotum
- Herb Layer



Beech Forest

中西 哲也（1983）：日本の植生図鑑（1）森林、 保育社

(2) Nature in Japan 2-6) Plants (2)

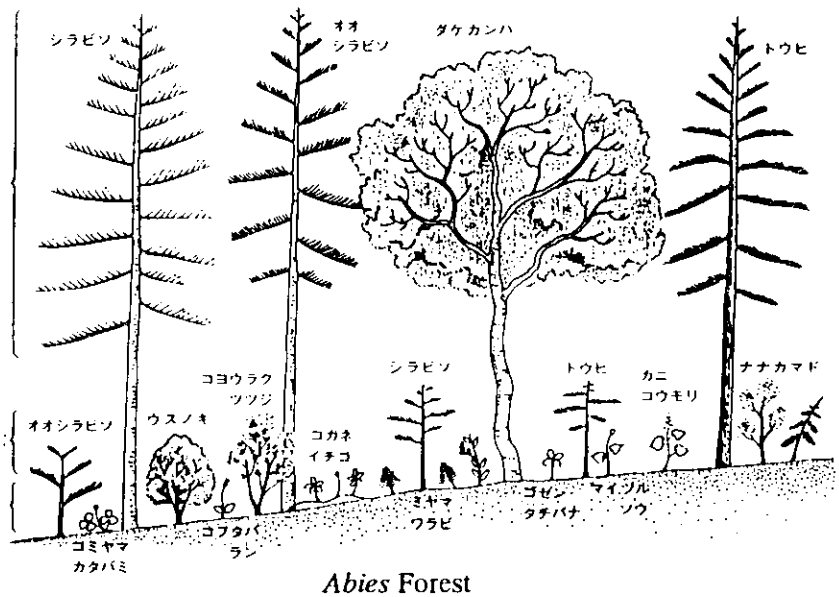
Typical Forest Types in Japan (2)

- Tree Layer
  Quercus glauca,
  Machilus thunbergii,
  Castanopsis sieboldii
- Sub-tree Layer
  Cleyera japonica,
  Ilex integra,
  Camellia japonica
- Shrub Layer
  Ligustrum japonicum,
  Neolitsea sericea,
  Aucuba japonica
- Herb Layer

Oak (Chinquapin) Forest

- Tree Layer
  Abies veitchii,
  A. mariesii,
  Picea jezoensis,
  Betula ermanii
- Shrub Layer
  Abies mariesii,
  Vaccinium hirtum,
  Sorbus commixta,

Herb Layer



Abies Forest

中西 哲也（1983）：日本の植生図鑑（1）森林、 保育社

(2) Nature in Japan

2-7) Vegetation

a) Zonation of vegetation

In the natural environment of Japan, the vegetation is mainly forest. With the change in temperature, Japanese forests change from south to north in the order of evergreen broadleaved, deciduous broadleaved, and evergreen coniferous forests. Vertically, a similar pattern of vegetational change occurs with change in temperature. The pattern of distribution of these types of forests is zonal and it is called forest zone, and many types of classification have been proposed since the late 1800's.

According to one of the most popularly widely used classifications, evergreen broadleaved forest is called warm temperate forest zone or evergreen oak (*Cyclobalanopsis* spp.) zone, deciduous broadleaved forest is cool temperate forest zone or beech (*Fagus crenata*) zone, evergreen coniferous forest is called boreal forest zone or *Abies sachalinensis / A. veichii* zone. Beside these classifications based on physiognomy, these are a variety of versions of pytosociological classification based on species composition of plant communities.

According to this phytosociological classifications, Camellietea-japonicae Region is equivalent to evergreen boadleaved forest zone, Fagetea-crenatae Region is deciduous broadleaved forest zone, and sub-arctic and sub-alpine natural vegetation represents evergreen coniferous forest zone.

Some features of those areas are as follows. In Camellieta-japoncae, Machilus thunbergii and *Castanopsis* spp. grow in forests near the seaside, whereas steep slopes and ridges, *Abies firma an*d *Tsuga sieboldii* are found. On the shallow soil of the seacoasts along the Pacific Ocean *Quercus phylliraeoides* grows, and *Pinus densiflora* occupies the poor soils of ridges.

In Fagetea-crenatae, which is represented by *Fagus crenata*, forests rich in *Quercus crispula* occupy ridges and dry slopes, and a rich flora of deciduous trees including *Fraxinus mandshurica* var. japonica, *F.spaethiana, Cercidiphyllum japonicum*, and *Aesculus turbinata* is found in moist bottomlands. Forest floors is often thickly covered with bamboo grass or dwarf bamboo, which is not seen in the equivalent types of forest in other parts of the world. The species of dwarf bamboo under beech forests on the snowy Pacific side and are different from the species on the very snowy Japan Sea side.

In sub-arctic and sub-alpine natural vegetation, the dominant species are *Abies veichii, A.mariesii* and *Tsuga diversifolia* in Honshu, and *A. sachalinensis* and *Picea jezoensis* in Hokkaido, but in Hokkaido a mixture of deciduous broadleaved species is common.

b) Human Activity and Vegetation

Vegetation growing presently without any direct human influence is called natural vegetation, and the classification of vegetation described above is based on the natural vegetation. Original vegetation means the vegetation before human activity started.

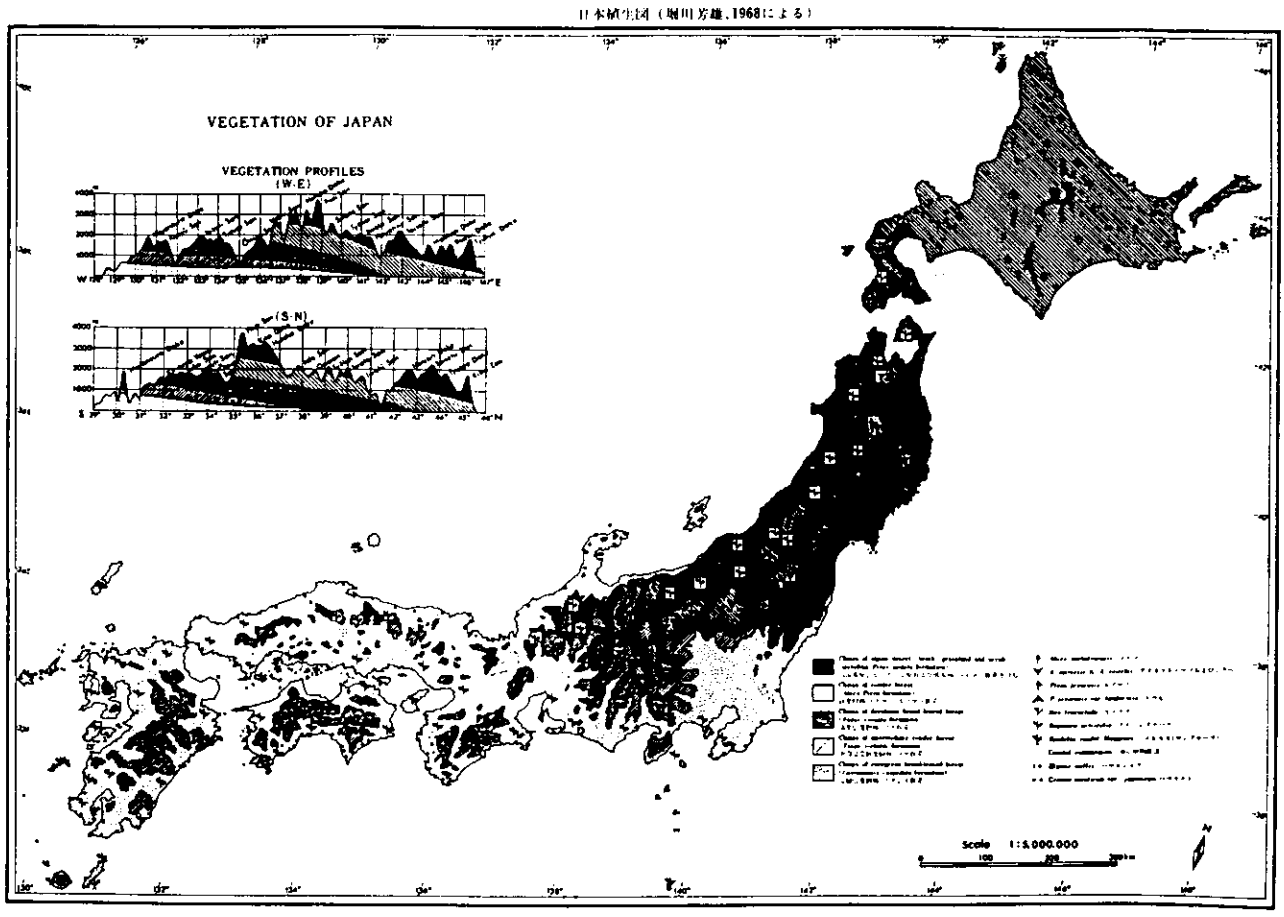
However, the vegetation actually found is modified by various activities of human beings and is different from natural vegetation. Natural vegetation is turned into such artificial vegetation types as paddy fields, agricultural lands, planted forests, grasslands, etc., which are quite different from natural types of vegetation. There are many forests which reverted to earlier stages of succession under the influence of forest fires or logging. Vegetation that is heavily influenced by human activity is called substitutional vegetation. The vegetation consisting of natural and substitutional vegetation is called actual vegetation.

Even if human influence is completely removed from actual vegetation, it will not necessarily go back to the original vegetation because of modifications of ground conditions. The vegetation which is supposed to come up finally after human influence is stopped is called potential natural vegetation.

佐藤 大七郎 （1982）： 日本の植生、日本の自然環境、 環境庁

(2) Nature in Japan 2-7) Vegetation

Vegetation of Japan



- Climax of alpine desert, heath, grassland and scrub
- Climax of conifer forest
- Climax of deciduous broad-leaved forest
- Climax of intermediate conifer forest
- Climax of evergreen broad-leaved forest

堀川 芳夫 (1968)：日本の植生地図、安田女子大学紀要 2 号

－ 佐々木 好之 編 (1973)：植物社会学、共立出版 より－