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Topography and Soil-Type for the Occurrence of Japanese White Birch

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The present paper deals with a primary study of distribution of *Betula platyphylla* SUKATCHEV var. *japonica* HARA, Japanese white birch, or *"Shirakamba"* by Japanese name, viewed in relation to topography and soil-types.

Betula platyphylla SUKATCHEV distributes widely in the temperate zone of Eastern Asia. Its variety, *Shirakamba*, distributes in Japan from the central Honshu to the north end of Hokkaido, growing roughly between 700m and 1750m above sea-level in the central Honshu. Because of its rather high growth rate, it now draws attention in forestry.

Shirakamba is a member of Amentiferae: Strobiles cylindric, 3—5cm long, 0.8—1.3cm in diameter; fruit ca. 2mm long, ca. 1mm wide, minute nut with wings; wings broader than nutlet. Nutlets are dispersed by wind in autumn. Strong light is required for germination. It frequently forms pure or nearly pure forests.

Results

a. *Topography preferred by* Shirakamba *forests*

Observations were carried out on 124 *Shirakamba* forests extending over the whole range of the distribution. In Fig. 1 is illustrated the frequency of occurrence of the forests, not including solitary growths, with respect to the topographic conditions, which are classified into three: mountain, valley and plain. By mountain are meant ridges and open slopes, and by valley the slopes facing each other. Slopes with inclination less than 30° will be referred to as gentle slopes, and those not less than 30° steep slopes.

It is apparent that *Shirakamba* forests occur mainly on gentle mountain slopes and level spots, and the species does not prefer steep slopes. Mountain ridges are not preferred either.

b. *Micro-topography and inhabitance of* Shirakamba

The stations selected for a study of the relation of *Shirakamba* to micro-topography were in an area, called Bunroku, between Honzawa Valley and Sakaizawa Valley (Fig. 3) near the Shiga Heights, Nagano Prefecture, central Honshu. Two or

more belt transects, 5m×50m each, were adopted along a contour line in each of the sixteen stations, from A to P in Fig. 3, and in a station, not shown in the map, on a steep mountain slope southwest of Futamata. The number of *Shirakamba* trees in percent of the total number of tall trees in each transect will be referred to as the mixture rate.

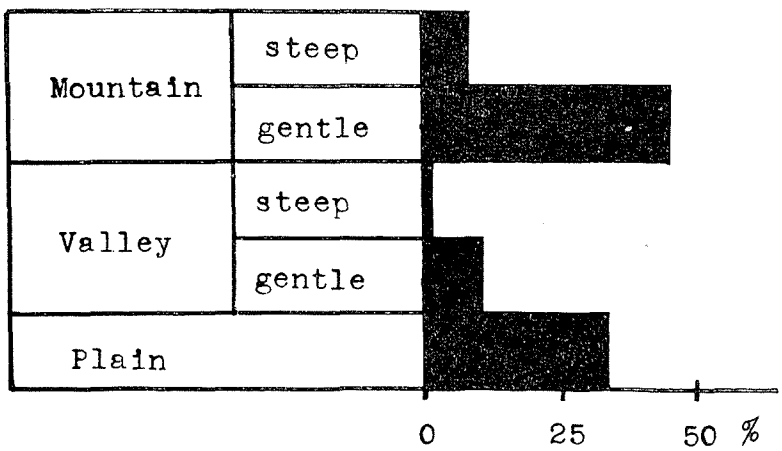

Fig. 1. Percentage occurrence of 124 *Shirakamba* forests on different topographic types, by the data collected from the whole distribution range in Japan.

So far as examined, most of *Shirakamba* trees in these stations were thirty years or a little more of age, except in station A where they were about twenty years old.

In Fig. 2 is shown schematically a section of Bunroku, with the value of mixture rate of *Shirakamba* indicated for each station. Station A slopes gently, and is covered by juvenile trees of *Betula Ermani* CHAMISSO and *Shirakamba*, while more steeply

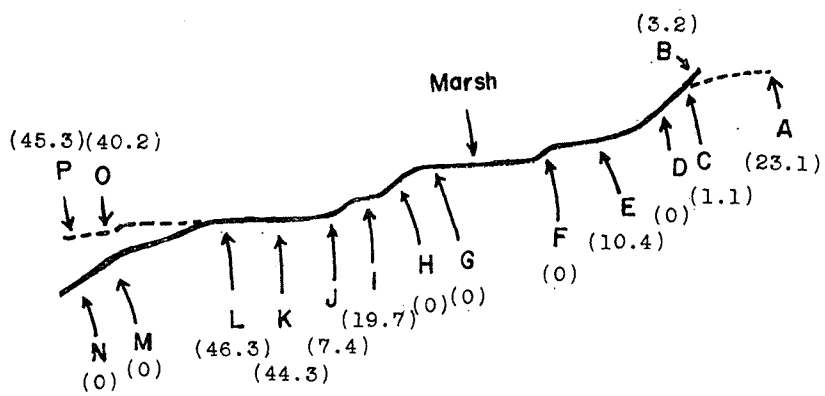

Fig. 2. Schematic topography at Bunroku and the mixture rate of *Shirakamba* at each station.

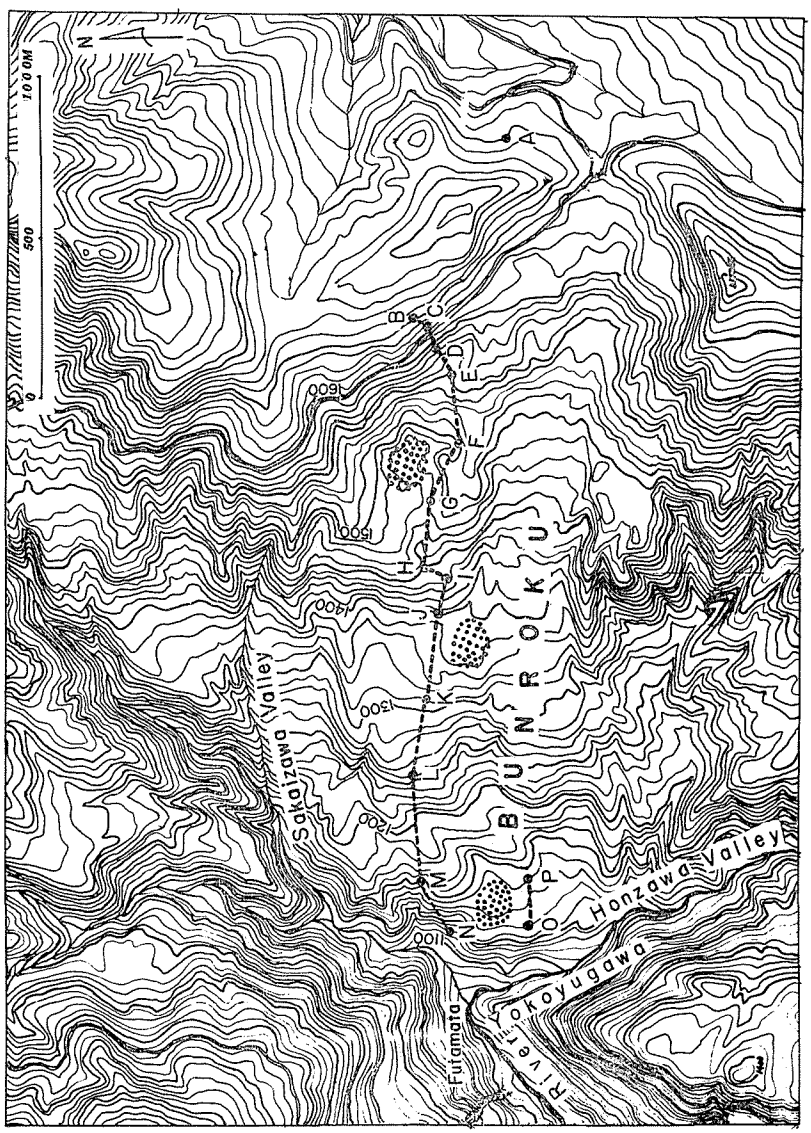

Fig. 3. Map of Bunroku near the Shiga Heights in Nagano Prefecture, central Honshu. Stations are represented by letters, from A through P. Investigations were made along broken lines. Dotted are very gentle slopes, where marshes are formed due to poor drainage in the thawing season.

sloped station B is dominated by *Fagus crenata* BLUME and *B. Ermani* CHAMISSO. *Shirakamba* is seldom found at steep stations D, F, H, M, and N, but it forms forests at other stations sloped gently. No *Shirakamba* grows, however, at G where marsh is formed in the thawing season due to poor drainage.

A schematic section of the station southwest of Futamata and the mixture rates at the various spots are represented in Fig. 4. Mixture rate is high on the gentle slope in the neighbourhood of 1180m in elevation. *Shirakamba* forms a forest also on a gentle mountain slope at 900m above the sea, not represented in the figure.

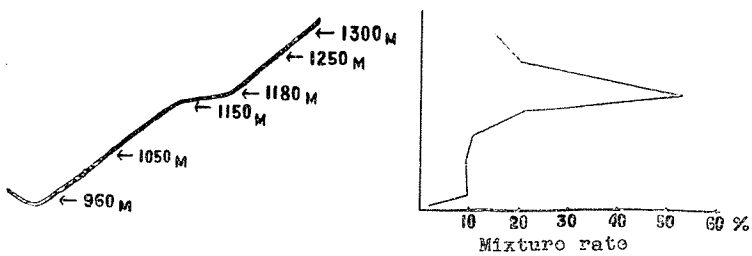

Fig. 4. Schematic topography of a spot southwest of Futamata, and the mixture rate of *Shirakamba* at each station represented by altitude.

c. *Soil-types of habitat*

Many *Shirakamba* forests grow on brown forest soils. With reference to OMASA brown forest soils may be classified as follows: B_A, dry brown forest soil (steep slope type); B_B, dry brown forest soil (gentle slope type); B_C, fairly dry brown forest soil; B_D, moderately moist brown forest soil; B_E, fairly moist brown forest soil; and B_F, wet brown forest soil.

Percentage frequencies of soil types of 124 *Shirakamba* forests observed are as shown in Fig. 5. Moderately moist brown forest soil (B_D) seems to be especially favourable for them.

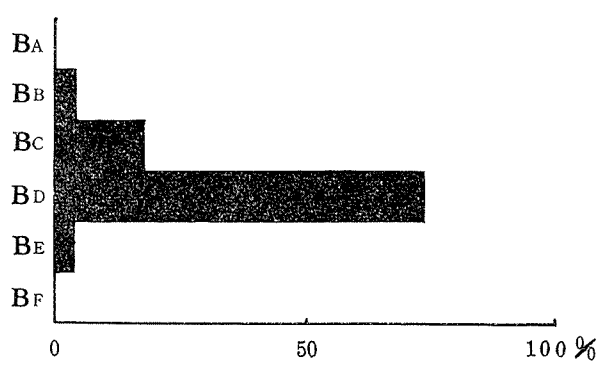

Fig. 5. Percentage occurrence of 124 *Shirakamba* forests with respect to soil types given in text.

Shirakamba trees grow, on the other hand, even on peat soil, Gley soil, and immature soil in some spots.

Discussion

It is pointed out in the above that the inclination of slope is a powerful factor determining the occurrence of *Shirakamba*. This factor appears to be decisive especially at the limit of distribution of the species: for example, *Shirakamba* occurs exclusively on gentle mountain slopes in upper reaches of River Nakatsugawa, southeast Gifu Prefecture, central Honshu.

The mode of life of a species is concerned with many environmental, abiotic and biotic factors. And the distribution of a species must be determined by the interrelationship of environmental conditions and the ensemble of its morphological, physiological and ecological natures. Studies on the relations of various factors with the life of *Shirakamba*, as well as of other *Betula* species, are in progress.

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Summary

Occurrence of forests of Japanese white birch (*Shirakamba*) was studied in relation to topography and soil-type.

1. A majority of the *Shirakamba* forests in Japan are on gentle slopes and level areas.
2. According to a survey conducted near the Shiga Heights, central Honshu, the mixture rate of *Shirakamba* among tall trees was high on gentle mountain slopes.
3. Although *Shirakamba* can live under various edaphic conditions, its preference for moderately moist brown forest soil is remarkable.

References

WILDE, S. A., 1946. Forest Soils and Forest Growth. Waltham, Mass.
OMASA, M., 1951. Forest Soils of Japan, Report 1. Tokyo.