

## GLOBAL WARMING AND THE ALPINE VEGETATION

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The Korean Peninsula's long north-south stretch and topographic complexity, and wide variations in the environmental conditions, as well as the absence of direct impacts of glaciation during the Pleistocene makes the and a diversified floral region.

At present more than 4,500 kinds of vascular plants, including about 400 endemics grow in the country. In the north and high mountain areas many coniferous and alpine plants are found. The central part and the western lowlands consists of temperate vegetation, such as broad-leaved deciduous trees and coniferous trees. The southern coast and offshore islands of Cheju and Ullung are regions where warm temperate plants grow abundantly.

Cheju Island, the largest island in the Korean peninsula, is situated 97km off the southern coast of the peninsula. It is an island province of about 1,825□ with a population of 520,000.

The island has typical marine climate, with a minimum January temperature of above freezing point. The total annual rainfall of Cheju Island ranges from 1,440 to 1,800mm, but more than 3,500mm at the peak of Mt. Halla, which is principal mountain of Cheju Island, a volcanic cone last active in 1007. At the summit of Mt. Halla, at 1,950 m a.s.l., is a large crater, Paeknokdam (700x400m, 210,230□).

Mt. Halla is characterised by an extremely impressive altitudinal zonation of its vegetation. Four main altitudinal vegetational belts, a subtropical, a temperate, a subalpine and alpine ones, are separated from approximately by the 700, 1,600 and 1,800 metre contour lines.

The subtropical vegetational belt is characterised by a predominance of evergreen broad-leaved plants. The temperate vegetational belt consists of a varied summer-green deciduous plants, along with sporadic penetration of evergreen plants. The subalpine vegetational belt, from c. 1,600m, contains conifers and shrubs. Finally alpine belt in which arctic-alpine plants, such as *Empetrum nigrum* var. *asiaticum*, *Diapensia lapponica* subsp. *obovata*, *Vaccinium uliginosum*, *Juniperus chinensis* var. *sargentii*, *Leontopodium coreanum* and so on occurs on the peak.

Out of the c. 380 Korean alpine plants 130 species occur in South Korea and 81 species grow on Mt. Halla, including 26 endemic alpine plants of Cheju Island (Mt. Sorak - 67 spp. ; Mt. Chiri - 54 spp.).

Large number of alpine plants on the summit of Mt. Halla is regarded as a relic species. Its present location resulting from the climatic changes which presumably occurred in the Quaternary period. Their distribution may also suggest that the Korean Peninsula, Cheju Island and possibly the Japanese Isles were once a connected land mass.

The alpine phytogeography of Mt. Halla, Cheju Island, Korea has discussed. The presences

of large numbers of the arctic-alpine flora on Mt. Halla, Cheju Island, at the mid of the Korea Strait between the Korean Peninsula and Japanese Islands, especially as the southernmost distributional limits of the earth for certain species may primarily be attributed to palaeo-environmental factors, since it can not be wholly explained by reference to present environmental conditions.

Floristic diversity and high endemism of Mt. Halla may be due to ; first, the long term isolation of island and summit from the Korean Peninsula since the Pleistocene, secondly, wide range of local environmental conditions (topography, climate, soil, vegetation, landscape *etc.*) provided and finally the absence of catastrophic environmental change in the past which ensured the survival of diverse floristic and vegetational elements.

The arctic-alpine flora on the peak of Mt. Halla, mainly above 1,500m a.s.l. are evidently descended from immigrants from NE Asia via the Korean Peninsula during the epochs of the Ice Age. These plants, which are very intolerant of competition, have been able to persist in alpine belts thanks to their harsh climatic conditions, sterile soil, rugged topography and cryoturbation. The distributional limits of the some species seem to coincide with the maximum summer isotherms.

The lapse rate of temperature on Mt. Halla marked  $-0.58^{\circ}\text{C}/100\text{m}$  for daily mean temperature,  $-0.53^{\circ}\text{C}/100\text{m}$  for daily maximum temperature,  $-0.62^{\circ}\text{C}/100\text{m}$  for daily minimum temperature. The limits of some alpine species of Mt. Halla seem to coincide with the daily maximum isotherms of  $23.5$  to  $18.7^{\circ}\text{C}$ , and they grow well on areas of relatively low summer temperature.

The presences of numerous alpine plants on Chejudo are mainly due to their relative degree of sensitivity to high summer temperatures. The distributional limits of the some typical alpine species seem to coincide with the maximum summer isotherms. Acquired data will be helpful to establish a conservation strategy which will ensure the continued survival of alpine plants near the summit.