Plants

comprehensive survey and data compilation process. The number of recorded species has increased since the full-fledged biological survey. In 2008, 33,253 species were recorded, with increases in subsequent years as follows: 39,150 in 2012, 50,827 in 2018, and 52,628 in 2019. The number of species native to Korea is expected to continue increasing as more surveys are conducted.

Korea is a temperate region; its flora is characterized by rich diversity and a high ratio of endemic plants, including endemic vascular plant genera, such as Pentactina, Abeliophyllum, Hanabusaya, Mankyua, and Megaleranthis. There are 4,576 vascular plant species documented in Korea, among which 335 are pteridophyta, 55 are gymnosperms, and 4,186 are angiosperms. Out of 4,186 angiosperms, 3,017 are dicotyledoneae, and 1,169 are 12,000 monocotyledoneae.

The rich floristic diversity and high endemism of Korea may be due to several factors. First, the Peninsula, which extends southward from Northeast Asia to the Japanese Islands (42° 2' to 33° 4' north latitude), accommodates a diverse distribution of plant and animal species. Second, the mountains and hills, which occupy nearly 65 percent of Korea's territory, contribute to diversity. A major mountain range that runs from the north to the south connects to other mountain chains on the Peninsula. The presence of about 4,000 islands provides an isolated, diverse geographical environment that accommodates diverse flora. Third, Korea has climatic variability. The mean annual temperature varies from

As of 2020, a total of 52,628 plant and animal species native to 16°C in Jejudo of South Korea to 5°C in the Gaemagowon (Gaema temperate to boreal also provide various conditions for diverse Korea have been catalogued. Among the native species, insects Highland) of North Korea. The Peninsula also experiences a wide plants to grow. Fourth, there is relatively little volcanic and seismic represent the largest proportion at 35.4%, with 18,638 species, range of temperature variations, e.g., a winter temperature low activity, and no extensive glacial activity. These conditions, followed by invertebrates (9,900 species), plants (5,517 species), of -45°C at Baekdusan, North Korea and a summer temperature combined with other conditions, such as complex bedrock and soil and birds (5,427 species). A survey conducted in 2000 recorded a high of 40°C in Daegu, South Korea. Mean annual precipitation systems, secured the survival of Tertiary flora. Finally, the Korean total of 28,462 species, which increased to 29,916 in 2005 after a also varies greatly, from 1,700 mm in Jejudo and along the Peninsula, which has served as a migration route and refuge during southern coastal region of South Korea to 950 mm in northern inland regions of North Korea. Distinct climatic zones from warm

both glacial and interglacial periods, has guaranteed the survival of both northern and southern floras.

Number of Native Species by Year

(Number of Species)



Status of Vegetation

leodo (Ocean Research Station) •



100 km



Dokdo 🔺

Major Plant Communities

Korean Red Pine (Pinus densiflora) Community





Mongolian Oak (Quercus mongolica) Community



Korean Red Pine (*Pinus densiflora*)-Mongolian Oak (*Quercus mongolica*) Community





National Institute of Ecology (2013)

Actual Vegetation Map



The actual vegetation map illustrates the spatial distribution of vegetation and provides baseline data for better management and proper use of the natural environment. The National Environmental Survey analyzed the status of the vegetation distribution, including all natural forests and plantations. The National Institute of Ecology produced the actual vegetation map based on recent satellite images and results of previous actual vegetation maps, maps of forest type, and ecology and nature maps from the second, third, and fourth National Natural Environmental Survey.

The Korean Red Pine (Pinus densiflora) community is the most common and representative forest type that can be found from Jejudo to Hamgyeongbuk-do. Traditionally Korean Red Pine forests have been protected and managed. Thus, they are broadly distributed in the whole country. However, the forests were severely damaged due to resin and wood collection during

Korean Red Pine (Pinus densiflora)-Oriental Cork Oak (Quercus variabilis) Community



Japanese Black Pine (Pinus thunbergii) Community



Oriental Cork Oak (Quercus variabilis) Community





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National Institute of Ecology (2013)

the Japanese colonial period. After 1970, pine forests had to be cut because of the rampant spread of pine leaf gall midge or Thecodiplosis japonensis and natural succession of broadleaf trees such as Mongolian oak (Quercus mongolica), which made Korean Red Pine dominant areas even smaller.

Mongolian oak (Quercus mongolica), which belongs to the family Fagaceae, is a deciduous broadleaf tree growing at high altitudes. It is distributed in the middle and southern parts of the country. South Korean forests are typically characterized by Mongolian oak communities. The species even covers 33.5% of the Baekdudaegan area. Mongolian oak is also a characteristic species of the boreal and temperate broadleaf forests of central Korea. It is known to have covered the southern lowlands 17,000-15,000 years ago, the central area (including the highlands) 10,000–4,500 years ago, and almost the entire country (excluding the Gaemagowon and Baekdusan) for the past 4,500 years.





Forest Type Map

Major Forest Types







National Institute of Forest Science (2013)

Mapping Processes



* Definition of Forest: Minimum Area of a Forest is 0.1 ha and Minimum Width is 20 m. Forests include Unstocked Forests or Barren Lands within the Forest Land

Forest type maps show the classification of forests into coniferous forest, broadleaf forest, and mixed forest, according to the species composition of the forest. Bamboo forests are classified into natural forests.

The maps of forest type have been produced at a scale of 1:25,000 with the National Forest Inventory five times since 1972. Maps started to be digitized from the third edition of the maps of forest type (1986–1992), and the production system was standardized from the fourth edition (1996–2005). More detailed 1:5,000 scale maps of forest type have been produced since 2009 in connection with the National Spatial Data System project. In 2012, 16,270 sheets of forest type maps of the whole territory were completed.

Coniferous forests are dominant in Gyeongsangbuk-do, while broadleaf forests dominate in Gangwon-do, where broadleaf forests make up 54.9% of the total forest area. This figure shows an increase in the area of coniferous forest (32.4%) compared to the data from the basic forest statistics in 1995. The area of coniferous forests is larger than that of broadleaf forests in Gyeongnam, Jeonnam, Gwangju, Daegu, and Busan. In the rest of the area, broadleaf forests occupy a larger area than coniferous forests.

Forests are divided into artificial forests and natural forests based on their origin. Korea's afforestation policy before 1970 focused on rehabilitating denuded mountainous areas. Large-scale artificial afforestation was conducted through two greening projects, which began in 1973. These projects have restored about 124,000 ha of forest. Through this, Korea has become a global success story for forest restoration.

Most of the artificial forests in the central region of South Korea are dominated by species such as Korean Pine (Pinus koraiensis), Japanese Larch (Larix leptolepis), and Pitch Pine (Pinus rigida). In the southern part of the country, Japanese Cedar (Cryptomeria japonica) and Hinoki Cypress (Chamaecyparis obtusa) imported from Japan are also planted. Artificial forests comprise around 15.5% of the total forest area. Natural forests are established from seeds, sprouts, or root suckers of trees already on or formerly occupying the land. Except for Korean Red Pine (Pinus densiflora), most natural forest areas regenerate naturally by sprouting. Tree species in the natural broadleaf forests are almost mutually exclusive. Generally, species richness per unit area of broadleaf forest is low, but pure stands are rarely formed. In most natural broadleaf forests, the high forest canopy is occupied by oak species, such as Mongolian Oak (Quercus mongolica), Sawtooth Oak (Quercus acutissima), and other types of trees such as Loose-flower Hornbeam (Carpinus laxiflora), Sargent's Cherry (Prunus sargentii), East Asian Ash (Fraxinus rhynchophylla), maples, palmate maple, East Asian white birch, birch trees, Amur Linden (Tilia amurensis), Japanese Elm (Ulmus davidiana), Wedding Cake Tree (Cornus controversa), and Manchurian Walnut (Juglans mandshurica). Underneath the canopy, the sub-tree layer is formed from Heartleaf Hornbeam (Carpinus cordata), Korean Maple (Acer pseudosieboldianum), Fragrant Snowbell (*Styrax obassia*), and other young arboreal trees.

Over half of Korea's natural forests are comprised of broadleaf trees, while over 80% of artificial forests are comprised of coniferous trees.

As of 2014, Korea's forest area occupied 63.2% of the national land. Korea has the fourth-highest ratio of forest per land area among OECD countries after Finland (72.9%), Sweden (68.7%), and Japan (68.5%). However, the forest area continues to decrease, while the land area continues to increase.

Forest Extent and Growing Stock



Korea Forest Service (2015

History of Forest Type Map

The 1st Forest Type Map Following the 1st National Forest Inventory (1972–1974), 783 sheets of forest type map at a scale of 1:25,000 were created for the first time. No contour lines were used, only the boundaries of different forests were displayed. The 1st Nationa Forest Inventory differentiated tree communities into the following three types: coniferous, broadleaf, and mixed forest.



The 2nd Forest Type Map

In accordance with the 2nd Nationa Forest Resource Inventory (1978-1980), 752 sheets of forest type map at a scale of 1:25,000 were created. As with the 1st Forest Type Map, plant communities were categorized into three major groups: coniferous, broadleaf, and mixec forest



The 3rd Forest Type Map

Based on the 3rd National Forest Resource Inventory (1986–1992), 742 sheets of forest type map at a scale of 1:25,000 were created. A digitizing project commenced for the first time and 751 digitized maps were also created. With the 3rd Forest Type Map, forest classification detailed major species, such as Pinus densiflora, afforested Pinus densiflora, Pinus koraiensis, Larix kaempferi, Pinus rigida, oak trees, Populus nigra, afforested oak trees, Castanea crenata, and afforested coniferous trees.



The 4th Forest Type Map

In consonance with the 4th National Forest Inventory (1996–2005), 750 paper forest type maps at a scale of 1:25,000 were created and digitized using the standard digital mapping method and system for forest type map. Standard mapping system for digital forest map (1:25,000) organized the mapping processes and quality control processe to minimize errors.



The 5th Forest Type Map

Since 2006, all forest type maps have been created using only the standard digital mapping method. Forest aerial photo DB was built with digital orthophotographs, and GIS based aerial photo interpretation system and image loaded field survey system were also developed as foundations for creating the digital forest type maps.



Forest Type Map at a Scale of 1:5,000 Since 2009, a 5-year plan for creating

a forest type map at a large scale (1:5,000) has been in operation. There are 16,270 maps covering the entire national forests that deliver detailed and accurate information on the national forest inventories



Natural Forests and Planted Forests



The average tree accumulation per 1 ha (100 m \times 100 m), gauging the lushness of vegetation, was 142.19 m³/ha in 2014, which has more than doubled compared to 63.5 m³/ha in 2000. This is higher than the OECD average (121.4 m³/ha) but is still lower than the United States (154.9 m³/ha), Germany $(315.3 \text{ m}^3/\text{ha})$, and Japan $(170.1 \text{ m}^3/\text{ha})$.

Forest Spatial Information Service





Digital forest type map is a representative forest thematic map that displays the distributions of various forest types. It is an important thematic map that is compiled on a national scale in addition to topographic map, soil map, geological map, and so forth. Compared to the paper-based forest type maps produced in the past, a digital forest type map is outstanding in data management and utilization, allowing fast and accurate data search and effective support for various planning and decision making processes.

National Institute of Forest Science (2013

Major Tree Species



The major tree species distribution map shows the distribution of tree species that can be easily found in the forests of South Korea. Loose-flower Hornbeam (Carpinus laxiflora) forests are native to Korean forests. But today, much of the native forest has been destroyed and replaced by oak species such as Mongolian Oak (Quercus mongolica), Sawtooth Oak (Quercus acutissima), Oriental Cork Oak (Quercus variabilis), and Jolcham Oak (Quercus serrata). Other species, including Black Locust (Robinia

Cherry (Prunus sargentii), and Snowbell Tree (Styrax japonicus) can be easily found in Korean forests.

National Institute of Forest Science (2013)

Station)

Jeju Specia

Self-Governing Province

The largest forest consisting of one species is a Korean Red Pine (Pinus densiflora) forest. The species has been protected under governmental policy, and lumbering has been prohibited. It is widely distributed in the entire country as it has a high tolerance for nutrient-poor soil conditions. Recently, however, the area covered by Korean Red Pine is decreasing because of wildfire, diseases pseudoacacia), East Asian Alder (Alnus japonica), Sargent's such as pine wilt, and insects such as Thecodiplosis japonensis.

The Korean Red Pine (Pinus densiflora) accounts for 21.9% of the total forests in South Korea. Although evenly distributed across the nation, they are most dominant in Gangwon-do and the eastern coasts of Gyeongsangbuk-do. In Andong-si and Uljin-gun of Gyeongsangbuk-do, the proportion of Korean Pine dominance is 49.9%. Changnyeong-gun of Gyeongsangnam-do shows the highest distribution rate among all cities of Korean Red Pine trees at 52.9%.

Oak species are the major broadleaf tree species in South Korea,

Ratio of Korean Pine (Pinus koraiensis) by Province

Distribution of Korean Pine (Pinus koraiensis) of Gapyeong-gun, Gyeonggi-do





National Institute of Forest Science (2013)

50 km

National Institute of Forest Science (2013)

including Jolcham Oak (Quercus serrata), Galcham Oak (Quercus aliena), Oriental Cork Oak (Quercus variabilis), Mongolian Oak (Quercus mongolica), and Japanese Emperor Oak (Quercus dentata). Oak covers 24.2% of the total forest area, which is higher than that of pines. Oak distribution is the greatest in Hongcheongun of Gangwon-do, followed by Inje-gun and Chuncheon-si. In Gimpo-si of Gyeonggi-do, 52.9% of forests are composed of oak species, which is the highest distribution rate among all South Korean cities.

Korean Pine (Pinus koraiensis) is an evergreen coniferous tree species and one of the oldest trees associated with Korean history, along with the Korean Red Pine (Pinus densiflora). It is distributed across the Korean Peninsula, Japan, China, and Siberia. Korean Pine is a species that adapts well to the cold, so its distribution is largely in mountainous and alpine regions. Its major habitats in Korea include Gapyeong-gun and Yangju-si of Gyeonggi-do and Hongcheon-gun of Gangwon-do. Korean Pine covers 2.4% of the total national forest area. With 20.0% of its forests composed

of this species, Gapyeong-gun of Gyeonggi-do has the highest distribution of Korean Pine among all regions.

Japanese Larch (Larix kaempferi) is a deciduous conifer. It is called deciduous pine because it belongs to Pinaceae, but it sheds its leaves annually. The species comprises 4.5% of the entire national forest. Hongcheon-gun, Pyeongchang-gun, and Jeongseongun have the highest Japanese larch population. With 19.1% of its forest comprised by this species, Taebaek-si of Gangwon-do displays the highest distribution rate of Japanese larch.

Pinus koraiensi 8 km National Institute of Forest Science (2013



	Larix Kaempferi
	River
-@-	National Highway
National Ins	stitute of Forest Science (2013

Natural History of Pine Tree (*Pinus* spp.)

Pine Tree (Pinus spp.) Fossils in Geological Time



The earliest occurrence of the genus of a pine tree or *Pinus* on the Korean Peninsula dates to the Cretaceous; the presence of Pinus spp. on the Korean Peninsula continued throughout the Miocene, Pleistocene, and Holocene to the present day. During the Quaternary, *Pinus* spp. had a wide distribution and maintained dominance over the Korean Peninsula. Pinus spp. later diversified into cold-tolerant and warm-tolerant species. Cold-tolerant Pinus spp. (haploxylon) with five needles occupied the northern and high mountains, but *Pinus* spp. (*diploxylon*) with two needles was common in lowlands and coastal regions.

Since the Holocene, *Pinus* species exhibiting niche characteristics have occupied different habitats and locations, becoming a dominant component of the vegetation. The dominance

of *Pinus* spp. is partially due to anthropogenic disturbances, such as agriculture, fire, and land-use patterns at lowland sites. Boreal *Pinus* species, including Dwarf Stone Pine (*Pinus pumila*), Korean Pine (Pinus koraiensis), and Chinese Hard Pine (Pinus tabuliformis), migrated into the Korean Peninsula during the Pleistocene glacial epochs, away from the harsh environment of northeast Asia. Their distribution is currently confined to the alpine and subalpine belts of the Korean Peninsula.

Black Pine (*Pinus thunbergii*) is found mainly in the southern and central-southern coastal areas of Korea. Ulleungdo White Pine (*Pinus parviflora*) occurs in isolation in Ulleungdo and some Japanese islands. Species like Black Pine (Pinus thunbergii) with larger, winged seeds and often dispersed by wind have wider

distributional ranges than species without winged seeds, such as Dwarf Stone Pine (Pinus pumila) and Korean Pine (Pinus koraiensis), which are dispersed by birds and rodents. These species have narrow distribution ranges around the montane and high mountain areas.

Species with disjunctive distributions, such as Dwarf Stone Pine (Pinus pumila) in the alpine and subalpine belts of northern and central Korea, Korean Pine (Pinus koraiensis) in mountainous areas, and Ulleungdo White Pine (Pinus parviflora) in Ulleungdo are more vulnerable to climate change such as global warming than other Pinus spp. Korean Red Pine (Pinus densiflora) and Black Pine (Pinus thunberigii) in lowland and coastal areas are under the influence of deforestation, overdevelopment, and insect outbreak.

Vegetation History of Pine Trees in the Historical Period

Distribution of Korean Red Pine in the Joseon Dynasty



Daedong jiji (1864)



Spatial and temporal changes in species for the vegetation history during historical times can be reconstructed using descriptions of local products and tributes from ancient documents of Korea.

Korean Red Pine (Pinus densiflora) is mainly distributed in the eastern regions like Gyeongsang-do and Gangwon-do. This could be explained by a distinct topographic condition of Korea due to the north-south running Taebaeksanmaek (Taebaek Mountain Range), conditions with rocky land and high altitude, relatively moderate temperatures, and low humidity, and by the natural environment and artificial conditions. A mild climate also explains the abundance of Korean Red Pine in Jeollanam-do, Jeollabuk-do, Chungcheongnam-do, and Chungcheongbuk-do.

The historical literature indicates temporal distribution areas of the Korean Red Pine (Pinus densiflora) as follows: 107 sites in the year 1454, 133 in 1531, 139 in 1660, 148 in 1760, 162 in 1842–1845, 125 in 1864, and 27 in 1931. Korean Red Pine was widely distributed throughout the nation from 1531 to 1864. The species was observed in 841 counties from 1454 to 1931. The species was observed in 107 counties in 1454, which increased to 162 counties from 1842 to 1845. The area of Korean Red Pine forests sharply decreased around 1931 due to excess forest use and forest lumbering under Japanese occupation. The extensive afforestation policies that started in the 1970s have led to the artificial planting of Korean Red Pine.

Distribution of Korean Pine in the Joseon Dynasty

Ø



Sinjeung dongguk yeoji seungnam (1531)

Daedong jiji (1864)





Dongguk yeojiji (1660) Yeoji doseo (1760) 0 Ø

Past distributions of Korean Pine (Pinus koraiensis) were reconstructed based upon descriptions in historical records of local products and by-products. The extensive distribution of Korean Pine during the 19th century and from 1530 to 1660 in high montane areas of eastern and northern Korea may indicate a relatively cooler climate. Counties with Korean Pine were few in 1454, 1760, and 1931, which may imply a milder climate at those times.

Korean Pine (Pinus koraiensis) was frequently present in northern, central, and eastern regions of Pyeongannam-do and Pyeonganbuk-do (84 counties), and Hamgyeongnam-do and Hamgyeongbuk-do (69 counties) of North Korea, and Gangwon-do (94 counties), Gyeongsangnam-do and Gyeongsangbuk-do (83 counties), and Chungcheongnam-do and Chungcheongbuk-do (46 counties) of South Korea. On the other hand, the species is rare in the lowlands and is mostly distributed in the western portion of the Korean Peninsula where the climate is relatively mild and wet, such as Jeollanam-do and Jeollabuk-do (18 counties) and Gyeonggi-do (13 counties) of South Korea, and Hwanghaenam-do and Hwanghaebukdo (23 counties) of North Korea.



Floristics and Floristic Regional Indicator Plants

Floristics on the Korean Peninsula



Plant distribution is determined by numerous environmental factors such as topography and climate and the dispersal ability of each plant species. The phytogeographical categories defining a region are based upon the plant's original characteristics. Such regions of plant distribution are called floristics. The floristics of the Korean Peninsula differs among scholars. Some include the entire Korean Peninsula in the Korea-Japan southern floristics, while others include only the Korean Peninsula excluding Baekdusan in the Korean-Japanese southern floristics. Floristics of the Korean Peninsula are classified into eight subgroups. The eight subgroups include Gwanseo, Gapsan, and Gwanbuk in North Korea and Jejudo, Ulleungdo, southern coast, southern region, and central region in South Korea. Plant groups selected through floristics analysis are divided into five classes according to their range. The selected floristic regional indicator plants are a group of vascular plants selected for assessing th natural environment. Floristic regional indicator plants can be used to determine the conservation priorities of major domestic species. It is also possible to compare the natural environment between regions by analyzing the distribution of classified floristic regional indicator plants. The floristic regional indicator plants represent 1,476 taxonomic groups: 258 taxonomic groups in Class V, 440 taxonomic groups in Class IV, 371 taxonomic groups in Class III, 207 taxonomic Tree, Asian Beach Jackbean, Chestnut-leaf Fern, Green Dragon, groups in Class II, and 200 taxonomic groups in Class I.

Class V is a protected endangered wildlife taxon or a taxonomic group that is comparable to a protected species due to the taxonomic group's small population resulting from extremely limited, discontinuous, or isolated habitat. Therefore, Class V are at risk for losing more than 5% of their Korean population or suffering severe damage equivalent to that by a single development or exploitation. Class V consists of 258 taxa, including the Pincushion Plant, Smoothlip Cymbidium, Akebian-fruit Orchid, Chinese Hawthorn, Whisk Fern, Bird's-nest Fern, Korean Lady's Slipper, Jeonju Pogostemon, Maehwamareum, Ulleungdo Cotoneaster, Seomhyunsam, Ulleungdo Turk's-cap Lily, and Yellow Surprise Lily.

Class IV is a taxonomic group that grows in one of four floristic subgroups. Class IV species have small numbers of populations due to sporadic distribution or have relatively large numbers of populations growing in groups. Class IV has a wider distribution than Class V or has somewhat larger species populations. Thus, it is somewhat less important than Class V. Class IV consists of 440 taxa, including Spike Rosebay, Geumgangchoronkkot, Camphor



Procumbens Chinese Juniper (Juniperus procumbens (Siebold ex Endl.) Miq.)

An evergreen coniferous shrub. Grows on the rocky walls of coastal islands in southern regions. Its stem is creeping. Leaves are acute cuspidate in acicular or lanceolate linear shape. It is a dioecious plant species, blooming in April. Male flower inflorescence is oval or ovate spherical. Fruits ripen in black purple in October of the following year.

Arabidopsis, and Korean Forest Poppy.

Class III is a taxonomic group that grows in two of four floristic subgroups. Class III species have small numbers of populations due to sporadic distribution or have relatively large numbers of populations growing in groups. Class III populations are distributed in less than half of the area within the floristic subgroup. Class III consists of 371 taxa, including Short-fruit Rosebay, Manchurian Isopyrum, Skunk Cabbage, Stauntonia Vine, Kadsura Vine, Yellowish Velvety-leaf Litsea, Round-leaf Indian Hawthorn, Glossy-leaf Paper Plant, East Asian Pollia, and Winter Raspberry.

Class II is a taxonomic group of species that either grow in a unique environment or have populations that are distributed nationwide, but Class II species generally grow in mountainous areas of about 1,000 m or higher. Class II consists of 207 taxa, including Rigid-branch Yew, Yalu River Primrose, Marsh Marigold, Korean Swamppink, Asian Common Seepweed, East Asian Seepweed, Herbaceous Seepweed, Marshfire Glasswort, Staunton's Bugseed, Frogbit, Channelled Water Plantain, and Slender Cattail.

Class I is a taxonomic group that grows in three of four floristic

Seomhyunsam (Scrophularia takesimensis Nakai)

Class V

A perennial herb, endemic plant of Ulleungdo. It grows to 100 cm. The stem is upright and has wings. It grows around the coast of Ulleungdo. It is a panicle, and the flower blooms purple in June and July.

subgroups. Class I species have small numbers of populations due to sporadic distribution or have relatively large numbers of populations growing in groups. It is the most widely distributed of the five floristic subgroups in Korea, so it is the least important in evaluating the natural environment. Class I consists of 200 taxa, including Singlespike Chloranthus, Stalkless-flower Eleuthero, Oldham's Meliosma, Evergreen Spindletree, Japanese Mallotus, Sericeous Newlitsea, Starflower Gromwell, and Songak.

The Korean Peninsula is home to 4,576 taxa of plant species. Five South Korean floristic regions contain about 3,300 naturally growing taxa. About one thousand taxa, including East Asian Edelweiss, Manchurian Poplar, and Big-bract Hare's Ear are estimated to grow in the central region; 1,300 taxa, including Korean Stewartia, Korean Winter Hazel, Korean Forest Poppy, and Siberian Lily grow in the southern region; 2,000 taxa, including Camphor, Wild Dampalsu, Waxberry, and other southern plant species grow in the Jeju region; and 700 taxa, including Pointed-petal Trillium, False Lily of the valley, and Giant Knotweed grow in Ulleungdo. Also, around 3,000 taxa, including Darkbark Spruce, Korean Viburnum, Korean Twisted-stalk, and Alpine Clubmoss, are found in Gwanbuk, Gapsan, and Gwanseo of North Korea.

Floristic Regional Indicator Plants Class IV

Floristic Regional Indicator Plants Class III





Rock Polypody

(Polypodium virginianum L.) A northern mountain plant. Mainly distributed in the north of the central region, such as Juwangsan in Gyeongsangbuk-do and Taebaeksan in Gangwon-do. It grows on thin soil over trees and rocks in moist forests in the mountains. It spreads by branching, creeping rhizomes. It has pinnatifid leaves, which are linear-lanceolate or lanceolate.



Common Bletilla

(Bletilla striata (Thunb.) Rchb. f.) A perennial herbaceous plant. It grows in groups in a slightly dry and barren place with much sunlight in the southern coastal area. It grows to 60 cm. The leaves are elongated ovate at 20-30cm long, 2-5cm wide, and the end is sharp. It bears 3-7 red-purple flowers on a raceme, which bloom in May-June.



Black Jetbead

(Rhodotypos scandens (Thunb.) Makino)

Class III

Natural Monument No. 371, A southern deciduous shrub. Distributed in the coastal regions in Gyeonggi-do, Jeolla-do, and Jeju-do. It grows on the edge of the forest. It grows to 2 m. Leaves are ovate at 4-8 cm long and 2-4 cm wide. One white flower blooms on a new branch in May-June.

Class III



Rodger's Bronzeleaf (Rodgersia podophylla) R. podophylla is a perennial herb living in shade and can be found in the high mountain lands of Gyeonggi-do, Gyeongsangbuk-do, and north to Gangwon-do. It grows up to 1 m



Korean Mountain Burnet (Sanguisorba hakusanensis) S. hakusanensis is a perennial herb distributed on high mountain ridges north of Jirisan, such as Jeollabuk-do, Gyeongsangbuk-do, Chungcheongbuk-do, and Gangwon-do. Its



Old World Forked Ferr (Dicranopteris linearis (Burm. f.) Underw.)

sometimes grows in groups.

A southern, mountainous plant. Distributed in the southern region, the southern coast region, and Jeju. It usually grows sporadically from the periphery of the valley on the mountain slope, in the forest, in sunny places on ridges and in relatively dark places. It

Dokdo 🌡

National Institute of Ecology (2020



Class V

National Institute of Ecology (2020

Class IV

height, and blooms with light yellow flowers on panicles between May and July.

flowers bloom on cylinder-shaped spikes between August and September.

Floristic Regional Indicator Plants Class II

Floristic Regional Indicator Plants Class I





Beach Morning Glory





Orange Campion (Lychnis cognata Maxim.)

A perennial herbaceous plant. It is a northern mountain plant that grows in semi-shaded or sunny grasslands or shrubs on the slopes or ridges of relatively high mountain areas in north of Jeollanam-do and Gyeongsangnam-do. It grows to 100 cm. An orange flower blooms at the end of the pedicel in July-August.



Korean Thistle

(Cirsium setidens) C. setidens is a perennial herb that can be easily found anywhere near forests or mountain valleys except in Jejudo and Ulleungdo. Commonly known as Gondre or Korean thistle, it flowers from July to October.



Curved-Utricle Sedge (Carex dispalata Boott)

Class I

Distributed nationwide. It grows in large clusters in wet places in mountainous areas or in wetlands at the edges of forests, around streams, and in standing water along rivers.



Sericeous Newlitsea

(Neolitsea sericea (Blume) Koidz.) A temperate evergreen tree. It is a southern mountain plant. On land, Bulgapsan in Jeollanam-do is its northern distributional limit. It particularly grows on islands in Ullengdo and in the south.



Monkshood

Class I

Class I (Aconitum jaluense) A. jaluense is a perennial herb that grows in forest shade and can be easily found anywhere in South Korea. It grows well in the rich soil of deciduous broadleaf forests at an altitude of 400 m or higher. Purple flowers bloom on racemose inflorescence during August and October.

Endangered Wild Plant Species

Distribution of Endangered Plants



The Ministry of Environment designated 92 specific wild animal and plant species for the first time in 1989. Currently, 267 species are under protection and management. Among these species, plants account for 88 species: 11 species of class I and 77 species of class II.

The Korean Peninsula is located between 33° N and 42° N and connected to the continent of Eurasia. It is a peninsular state, easily affected by continental and oceanic climates. The Korean Peninsula is long from north to south and shows distinct seasonal changes with numerous mountainous regions showing diverse flora. Distinct climatic and geographic characteristics allow the coexistence of southern and northern plants throughout the whole country. Among Korea's endangered plant species, 24 species are northern plants, and 30 are southern plants. The distribution range and the distributional limit of these plants are expected to change under climate change scenarios. Particularly, the population of northern plant species and their distribution range are decreasing.

Currently, 15 of 436 endemic species are designated as endangered wild plant species. Also, as orchid species are severely declining due to illegal collection, 19 orchid species are under legal protection to eradicate illegal collection.

The IUCN Red List of Threatened Species

and so forth.

Mankyua (Mankyua chejuense)

Diapensia lapponica var. obovata is the world's smallest shrub and has survived the glacial Endemic to South Korea, it grows naturally in Gotjawal of Jejudo. It preserves the morphology era. In Korea, a small population remains only at the summit of Hallasan, which is the southern of the primitive bracken fern family. It has experienced a decrease in population due to large-



Northern Water Hemlock (Cicuta virosa) Class II A northern aquatic plant. Distribution limited to certain areas of Gangwon-do and Jeollabukdo. It grows in communities in mountainous wetlands or old reservoirs. Thus it has experienced a decrease in population due to wetland development and ecological succession.



Korean Lady's Slipper (Cypripedium japonicum) Class I A small population of Cypripedium japonicum remains in the regions of Gyeonggi-do, Gangwon-do, Jeollanam-do, Jeollabuk-do, and Chungcheongbuk-do. Affected by illegal collection and characterized by a low seed setting rate, the species displays high fluctuation in distributional limit for this species. Often this shrub is incidentally swept away by wind and scale developmental projects and illegal collection. population numbers.



Yellow-Flowered Rosebay (Rhododendron aureum) Class II A small population is found at the Seoraksan summit. Endangered and vulnerable to climate change, it is a northern plant commonly distributed at elevations between 1,800 and 2,400 m from Yeoju-si of Gyeonggi-do to Cheongju-si of Chungcheongbuk-do. Its population fluctuates on Baekdusan.



Pincushion Plant (Diapensia Iapponica var. obvata)

landslides.



Danyang Aster (Aster altaicus)

Class II Endemic to South Korea. It grows naturally on fields of pebble and sand alongside Hangang depending on a variety of factors, including habitat loss caused by stream flooding.





plant species, accounting for 40% of the total.

The International Union for the Conservation of Nature (IUCN) has been collecting and managing data on the conservation status of plant and animal species since 1963. Species are classified into nine groups (Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened, Conservation Dependent, Least Concern, Data Deficient, Not Evaluated), which are assessed by criteria such as population, geographic distribution, risk of extinction,



Class II

Rare Plant Species

Distribution of Rare Plant Species

Geumgangchoronkkot (Hanabusaya asiatica), Dwarf Siberian Pine (Pinus pumila), Woodland Peony (Paeonia obovata), Chilbo Metanarthecium (Metanarthecium luteoviride) Modemipul (Megaleranthis saniculifolia) Round-Leaf Sundew (Drosera rotundifolia), Biro Gentian (Gentiana jamesii), Corniculate Spurred Gentian (Halenia corniculata), Chinese Pearleaf Crabapple (Malus asiatica), Alpine Broad-Leaf Allium (Allium victorialis), Slim-Stem Lily (*Lilium callosum*), Rocky Forsythia (Forsythia saxatilis), Korean Spreading Yew (Taxus cuspidata var. nana), Korean Monkshood (Aconitum coreanum) and Miss Kim Lilac (Syringa patula) Korean Lady's Slipper (*Cypripedium japonicum*), Cowberry (Vaccinium vitis-idaea), and Spike Mulberry Mistletoe (Loranthus tanakae) Komarov's Hawthorn (Crataegus komarovii), and Spotted Lady's Slipper (Cypripedium guttatum) Miseonnamu (Abeliophyllum distichum) Vesper Iris (Iris dichotoma), Miseonnamu Diverse-Leaf Jack-in-the-Pulpit (Abeliophyllum distichum), (Arisaema heterophyllum) Big Violet (Viola websteri), Maehwamareum Narrow-Leaf Solomon's Seal (Ranunculus kazusensis) (Polygonatum stenophyllum), and Shore Juniper and Fine-Leaf Lily (Lilium pumilum) (Juniperus rigida var. conferta) Korean Necklace Pod (Echinosophpra koreensis) Asian Twinleaf (Jeffersonia dubia), Beach Silvertop (Glehnia littoralis), Odaesan Iris (*Iris odaesanensis*). Cucullate Neottianthe Orchid Round-Leaf Hylotelephium (Neottianthe cucullata), (Hylotelephium ussuriense) Elongate Korean Lespedeza Ulleungdo Jack-in-the-Pulpit (Lespedeza maximowiczii var elongata) (Arisaema takesimense) Large-Leaf Paniculous Suppleiack Ulleungdo Abelia (Abelia biflora), (Berchemia floribunda) Ulleungdo Hare's Ear Maximowicz's Hololeion (Bupleurum latissimum) (Hololeion maximowiczii), Nodding Lily (Lilium cernuum), Common Bladderwort False Lily of the Valley (Utricularia vulgaris var. japonica), (Maianthemum dilatatum), and Common Calanthe and Trilobe Monkshood (Calanthe discolor) (Aconitum austrokoreense) Geumgangchoronkkot (Hanabusaya asiatica) leodo Ocean Research Dwarf Woodland Korean Iris (Iris koreana) Bifid Bladderwort (Utricularia bifida), Station) Byeonsan Winter Aconite Purple-Flower Bladderwort Goldenrain Tree (Eranthis byunsanensis), (Koelreuteria paniculata) (Utricularia yakusimensis), Orange-Flower Surprise Lily (Lycoris sanguinea), and Linear-Leaf Leucantheme Uydo Surprise Lily (Lycoris uydoensis), (Leucanthemella linearis) and Siberian Lily (*Lilium dauricum*) East Asian Shield Sundew (Drosera peltata var. nipponica), Maritime Jujube (Paliurus ramosissimus), Korean Kirengeshoma (Kirengeshoma koreana), Dark-Bark Spruce (Picea jezoensis), Korean Fir (*Abies koreana*), Nadopungran (*Sedirea japonica*), Prickly Waterlily (*Euryale ferox*), Yellow Rosemallow (Hibiscus hamabo), Big-Root Cymbidium (Cymbidium macrorhizon), Dwarf Juniper (Juniperus chinensis var. sargentii), Pincushion Plant (Diapensia lapponica var. obovata), Seokgok (Dendrobium moniliforme) Tall Oplopanax (*Oplopanax elatus*), Akebian-Fruit Orchid (Cyrtosia septentrionalis), Island Devilwood (Osmanthus insularis), Alpine Modest Primrose Hanran (*Cvmbidium kanran*), . (Primula modesta var. hannasanensis), Baekyang Broomrape (Orobanche filicicola), Bird's-Nest Fern (Asplenium antiquum), and Glabrous Colicroot (Aletris glabra) Baekun Kuhlhasseltia Orchid (Kuhlhasseltia nakaiana), and Island Golden Calanthe (*Calanthe sieboldii*) and Sickle Neofinetia (Neofinetia falcate)

Korean Pentactina (Pentactina rupicola)

Number of Korean Rare Plant Species by Conservation Grade

Classification	dophyta	perm	tyledon	tyledon	Total	
EW (Extinction in the Wild)	2	-	1	1	4	
CR (Critically Endangered)	20	2	80	42	144	
EN (Endangered)	15	1	82	24	122	
VU (Vulnerable)	16	4	79	20	119	
Total	53	7	242	87	389	
Other	I.C. (Least Concerned) 70. DD. (Data Deficient) 112					

Korea National Arboretum (2008)

Many wildlife species are endangered by habitat change caused by climate change and global warming. The IUCN warns that around 30% of global plant resources in the 21st century will face the crisis of extinction.

Along with the global effort to conserve rare plant species, scholars in South Korea are collecting basic data and conducting research projects on native flora. First, 571 rare species were selected based on an endangered plant assessment standard and category proposed by the IUCN in 2008. Selected rare plant species have been catalogued by their grade and used as basic data for conservation.

Rare plant species in South Korea are classified into four classes: four extinction in the wild species, 144 critically endangered species, 122 endangered species, and 199 vulnerable species.



Korea National Arboretum (2008)

Also, there are 70 species in the category of least concerned and 112 species in the category of data deficient. Taxonomically, there are 53 pteridophytes, 7 gymnosperms, 242 dicotyledons, and 87 monocotyledons of angiospermae.

The Korean National Arboretum and associated institutions are putting effort into conserving biodiversity by conducting local conservation, propagating endangered plant species, and recovering natural habitats.

Endemic plants are native plants that grow in limited places. The population of an endemic species generally decreases or is maintained as a small group because an endemic species is either a remnant species that was once widely distributed but became confined to small areas due to environmental factors or a new species created by regional speciation.



Jejugosarisam (Mankyua chejuense)

Of 4,171 native plant species based on the 2015 Korean Plant Names Index, 328 are endemic species, accounting for 7.8% of the total native plant species.

Among Korean endemic plant species, six species show distinctive taxonomic and morphological differences compared to other plant species. Those are Miseonnamu (Abeliophyllum distichum) found in Jincheon of Chungcheongbuk-do, Korean Necklace Pod (Echinosophora koreensis) found in Bukcheong of Hamgyeongbuk-do, Geumgangchorongkkot (Hanabusaya asiatica) and Korean Pentactina (Pentactina rupicola) found in Geumgangsan, Modemipul (Megaleranthis saniculifolia) found in Jirisan, and Jejugosarisam (Mankyua chejuense) found in Jejudo. They hold a high plant resource value because each plant species is the only species of its genus.

Invasive Alien Plants

Major Invasive Alien Plants



Korea National Arboretum (20)



Giant Ragweed (Ambrosia trifida)

An annual plant belonging to the sunflower family (Asteraceae), native to North America. It grows up to 3 m and is found mainly along the riverside. Most leaves are oppositely arranged and are deeply divided into 3-5 lobes like a maple leaf. The species is monoecious. The fruit is an achene 6-12 mm in size with several tiny spines.



Jeju Special

overning Province

Bur-Cucumber (Sicyos angulatus)

Bur-Cucumber (Sicyos angulatus)

An annual vine belonging to the gourd family (Cucurbitaceae), native to North America. It grows up in vines along the riverside. The stems are hairy. The alternate leaves have three to five palmate lobes. Flowers bloom in the axils of leaves from July to October and are ovate, and serrated at the edge. White flowers bloom from July to September. Fruit ripens in entomophilous flowers. The fruit is long, egg-shaped, gathered in clusters, and covered with long thorns.







Common Cordgrass (Spartina anglica)

A perennial halophyte from the southern coast of England belonging to the Poaceae family. It is yellow-green and grows 40-130 cm, in clusters, in spring and summer. The leaves are thick, long, and blade-shaped and 20–60 cm long. In the tidal flat, the roots are entangled, destroying the habitat of surrounding plants and benthic organisms.





• Bur-Cucumber Korea National Arboretum (2020

🦸 Ulleungdo



White Snakeroot (Ageratina altissima) A perennial herb belonging to the Asteraceae family, native to North America. It grows to 30-130 cm. It forms a colony in open forests around Seoul and Gyeonggi-do. Leaves are opposite, November and is a black achene.

Alien plants are plant species that have been indigenous through several generations in a natural ecosystem after being accidentally or intentionally introduced into Korea by human activities. Most plants imported from abroad, such as flowering plants that need continuous management, cannot settle in the domestic climate environment. Some plants successfully reproduce in Korea. There are about 400 species of alien plants in Korea.

Most alien plants have little impact on the domestic ecosystem. However, some alien plants reduce biodiversity and cause socioeconomic damage. In particular, invasive alien plants are plants that disturb or are likely to disturb the balance of the ecosystem in a specific area. The Minister of Environment designates and announces invasive alien plants through the ecosystem risk assessment process. The invasive alien plants are not limited to alien plants. However, as of 2020, all of the invasive alien plants of the 16 classification groups are alien plants except for Japanese Hop (Humulus japonicus).

Alien plants, designated as invasive alien plants, have better reproductive capacity than native species and have broad environmental tolerances, so they spread widely in a short period of time. Bur-cucumber, Giant Ragweed, Late Goldenrod, and Common Cordgrass reduce biodiversity by repelling native plant communities and forming single colonies. Rapid changes in plant populations caused by the reproduction of invasive alien plants can also lead to disruption of the ecosystem food chain. In addition, pollen of Annual Ragweed, Japanese Hop, and Giant Ragweed negatively affect human health by causing allergies. They also cause damage to the agricultural and livestock industries by invading pastures and agricultural lands.

Climate change and habitat destruction caused by humans increase the likelihood of the spread and settlement of alien plants. Climate changes, such as increased temperatures, changes in precipitation, and frequent flooding, are threats to endangered species but are opportunities for invasive alien plants to spread rapidly. Most invasive alien plants settle quickly in disturbed environments rather than in stable ecosystems. Therefore, continuous monitoring and research on management measures reflecting species characteristics are required to prevent the impacts to the ecosystem and social and economic damage caused by invasive alien plants.





Prickly Lettuce (Lactuca scariola)

An annual or biennial plant belonging to the daisy family (Asteraceae), native to Europe. It grows to 60-130 cm and grows well in dry soil such as roadsides and vacant lands. The leaves are similar to lettuce leaves, but they are long and sharp. There are thorns in the main vein on the back of the leaf. Flowers bloom from July to September, and the fruit is long, oval, and has white pappus.









Natural Monuments

Distribution of Representative Natural Monument Plant Species



Natural monuments bear high academic and aesthetic value. Thus, legal protection and conservation have been adapted. Natural monuments include animals and their habitats, plants and their natural colony areas, minerals, caves, and other natural and inorganic substances. As of 2020, there were 264 plant natural monuments, including 172 old trees, 19 rare plant species, 13 distributional limits, 13 natural habitats, 24 forest and vegetation areas, and 23 village groves.

State-designated plant natural monuments include endemic plant species, and plant species growing in special environmental conditions such as dry land, wetlands, rivers, waterfalls, and hot

springs. The list of state-designated plant natural monuments also includes plant species at their geographical distributional limit, famous trees, old trees, communities of broadleaf evergreen vegetation, specific plant communities, plant species at the distributional limit of their range, abnormally-shaped trees, holy trees at sanctuaries and village shrines, forests for fish shelter, primeval or virgin forests, alpine plants, and artificially planted historic woodlands.

State-designated plant natural monuments are mostly Ginkgo (Ginkgo biloba L.), Japanese Zelkova (Zelkova serrata), Korean Red Pine (Pinus densiflora), and Chinese Juniper (Juniperus

chinensis). Many-stem Korean Red Pine (Pinus densiflora f. multicaulis Uyeki), Retusa Fringetree (Chionanthus retusus Lindl. Paxton), Lace-bark Pine (Pinus bungeana Zucc. ex Endl.), Hoehwanamu (Sophora japonica L.), Black Pine (Pinus thunbergii Parl.), Oriental Cork Oak (Quercus variabilis Blume), Maesilnamu (Prunus mume (Siebold) Siebold & Zucc.), Nut-bearing Torreya (Torreya nucifera (L.) Siebold & Zucc.), Giant Pussy Willow (Salix chaenomeloides Kimura), Prickly Castor Oil Tree (Kalopanax septemlobus (Thunb.) Koidz.), Trifoliate Orange (Citrus trifoliata L.), Scabrous Aphananthe (Aphananthe aspera (Thunb.) Planch.), and Thunberg's Bay-tree (Machilus thunbergii Siebold & Zucc.) are



Smoothlip Cymbidium (Cymbidium kanran) of Jejudo



nent No. 88 | Old Tree Songgwangsa Temple, Suncheon, Alpine Juniper (Juniperus sibirica Burgsd.)



Natural Monument No. 103 | Old Tree Songnisan, Boeun-gun, Jeongipumsong Pine Tree





Daesong-ri, Haman-gun, Swamp Plants



Naejangsan, Macropodous daphniphyllum (Daphniphyllum macropodum Miq.) Community



Jatural Monument No. 19 | Natural Habitat, Di Tokkiseom, Jejudo, Poison-Bulb (Crinum asiaticum var. japonicum Baker)



Natural Monument No. 8 | Old Tr Jae-dong, Seoul, Lace-Bark Pine (Pinus bungeana Zucc. ex Endl.)



Hwabangsa, Namhae, Montane False Ohelo (Wikstroemia trichotoma (Thunb.) Makino)



Songdeok-ri, Goesan-gun, Miseonnamu (Abeliophyllum distichum Nakai)

also natural monuments

Among the old trees, most of the designated natural mo are Ginkgo, Japanese Zelkova, Korean Red Pine, and Chinese Juniper. Pine trees, including Korean Red Pine, Many-stem Korean Red Pine, Lace-bark Pine, and Black Pine, are designated the most. Old trees, communities, and the northern distributional limit of nut-bearing torreya are state-designated natural monuments of Korea. The natural habitats of the endemic species, Miseonnamu (Abeliophyllum distichum), are also state-designated natural monuments of Korea.

Rigid-branch Yew (Taxus cuspidata Siebold & Zucc.) is an evergreen tree belonging to the Taxaceae family that grows in Korea, Japan, Manchuria, and Russia. In Korea, it mainly grows on Baekdudaegan, a backbone of the Korean Peninsula. It has a reddish-brown heartwood. Flowering occurs in April, and red arils ripen from September to October. The woody part of the plant is widely used to make handicrafts such as checkerboards and woodwork, and the fruit is used for food and medicinal purposes.

The Rigid-branch Yew community (Natural Monument No. 244) in Sobaeksan and old Rigid-branch Yew trees (Natural Monument No. 433) in Duwibong, Jeongseon-gun are designated as Natural Monuments.

In the Rigid-branch Yew community (Natural Monument No. 244) in Sobaeksan, over 100 old trees grow on the western part of the peak of Birobong. The stems are twisted, and the side branches are bent up and down to show a mysterious appearance. Their height is about 7 m. The circumference at 1.5 m from the base varies. Branches grow in all directions at 2 m or lower due to the



Samdo, Jejudo, Bird's Nest Fern (Asplenium antiquum Makino)

influence of strong wind and snow. Other trees, including Oriental very rare in Korea, so it is the only plant for which the species Flowering Cherry (Prunus jamasakura Siebold ex Koidz.), Asian Hazel (Corylus heterophylla Fisch. ex Trautv.), and Mongolian Oak (*Quercus mongolica* Fisch. ex Ledeb.) grow around the yew community. A community of Modemipul (Megaleranthis saniculifolia), one of the species endemic to Korea, lives near the ridge. The Rigid-branch Yew community in Sobaeksan is Korea's representative Rigid-branch Yew community and has been designated as a natural monument because of its high biological preservation value.

Three old Rigid-branch Yew trees (Natural Monument No. 433) grown on the ridge of Duwibong, Jeongseon-gun. The three yew trees stand side by side. The age of the yew tree growing in the center is estimated to be about 1,400 years, and the age of the other yew trees is estimated to be 1,200 years. These yew trees are beautiful in shape and the oldest of their kind in Korea with great academic value.

Smoothlip Cymbidium (Cymbidium kanran Makino) blooms in the cold winter from December to January. It has 3–4 leaves 20–70 cm long. It is distinguished from Goering Cymbidium (Cymbidium goeringii (Rchb.f.) Rchb.f.) because the leaves have sharp tips and soft edges and grow flat. Flowers blooming in winter are yellowgreen or purple in color and are very fragrant.

Smoothlip Cymbidium in Jejudo grows at the entrance of Donnaeko Valley and the evergreen forest between Sioreum and Seondol (south of Hallasan), which is located at an altitude of 700 m. These areas are at the northern distributional limit in which Smoothlip Cymbidium can grow wild. Smoothlip Cymbidium is



Naridong, Ulleungdo, Ulleung dendranthema (Dendranthema zawadskii var. lucidum (Nakai) J.H.Park) and Ulleungdo Thyme (Thymus quinquecostatus var. magnus (Nakai) kitam.) Community

itself is designated as a natural monument (Natural Mon 191). The Donnaeko Valley was designated as Natural Monument No. 432 to protect the colony of Smoothlip Cymbidium that grows in the valley.

Macropodous Daphniphyllum (Daphniphyllum macropodum Miq.) is a small, arboreous evergreen tree belonging to the Daphniphyllaceae family that grows in Korea, China, and Japan. In Korea, it is distributed in Anmyeondo of Chungcheongnamdo, Ulleungdo of Gyeongsangbuk-do, and Naejangsan of inland Jeollabuk-do. Generally, it grows in warm regions such as the southern coastal area of Jeollanam-do and Jejudo.

Oriental herbal medicine or folk remedies have used the leaves and bark of Macropodous Daphniphyllum as a cure for acute pleurisy and peritonitis or as a diuretic and an anthelmintic. This tree was once greatly damaged because its leaf shape resembles that of Shortfruit Rosebay (Rhododendron brachycarpum D.Don ex G.Don), which is also used as a medicinal plant. After the new leaves of this tree grow, the old leaves fall off. For this reason, Japanese people regard this tree as a symbol of January, and they decorate their floors with the leaves of this tree on the first day of the New Year.

Unusually large Macropodous Daphniphyllum trees are rare in Korea and grow in the Macropodous Daphniphyllum community in Naejangsan, which was designated as Natural Monument No. 91 in recognition of its academic value as the northern distributional limit. When broadleaf evergreen forests in the Korean Peninsula expand due to global warming, the area of the Macropodous Daphniphyllum community is expected to increase.

Plant Phenology by Climate Change

Prediction of Leaf-Out Dates under Future Climate Scenarios



According to the IPCC 4th Assessment Report, the global average temperature has risen by 0.76°C over the past century, and the average temperature in the 2100s is expected to rise 1.1–6.4°C from the 2000s. As the temperature increases, the vegetation zone Detection of changes is possible by observing the microclimate, of the Northern Hemisphere is moving from the south to the north and from lowlands to highlands. An increase by 1°C is expected to cause a migration of mid-latitude plants by 150 km to the north

and 150 m higher in altitude, making it difficult for most plant species to keep up with the speed of climate change. Thus, the chance of extinction or shrinkage of habitat for plants increases. seasonal variations, and physiological changes of plants' blooming change. Habitat change and distribution area change are predicted and bearing fruit through long-term monitoring.

Since 2009, the Korea National Arboretum has been carrying forward plant species are likely to appear because of global warming.

an adaptation plan for forest plant species susceptible to climate change. The plan designates 100 climate change vulnerable species and monitors them after classifying them into either northern or southern species. Plant species will physiologically be influenced by climate as consequences of interspecific competition. Thus, new endangered



The winter bud burst season and leaf unfolding season of Rigidbranch Yew and Korean Fir are expected to start earlier. Highland plants such as Korean Fir, Dark-bark Spruce, Korean Crowberry, Rigid-branch Yew, Khingan Fir, and Korean Arborvitae are expected to decrease in population. Conservation of northern plants living in isolated environments such as alpine, sub-alpine, islands, and wind holes is becoming an important issue.

RCPs are a series of climate change scenarios used to not seen as a feasible plan. RCP 4.5 (540 ppm of CO₂) suggests determine greenhouse gas reduction policies per socioeconomic that greenhouse gas reduction policies will be carried out to a setting. Four trajectories are presented upon calculations of considerable degree, while RCP 6.0 (670 ppm of CO₂) projects different levels of carbon dioxide concentration. RCP 2.6 (420 will be carried out to some degree. RCP 8.5 (940 ppm of CO2) ppm of CO₂) projects that Earth will be able to recover from predicts that greenhouse gases will continue to be emitted at the negative consequences of human activity by itself, but it is the current rate without any reductions.

