

Vascular Plant Diversity of Jeju Island, Korea

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Abstract - The vascular plants in Jeju composed of 21 families 62 genera, 190 species, 7 varieties with 197 taxa in Pteridophyta, 3 families 5 genera, 7 species, 3 forma with 10 taxa in gymnosperm (Coniferophyta) and 143 families 703 genera, 1,622 species, 114 varieties and 47 forma with 1,783 taxa in Endospermae. The total number of taxa was 1,990 consisting 167 families, 770 genera, 1,818 species, 121 varieties and 50 forma. Three families, 4 genera 4 species and 1 variety in Pteridophyta and 1 family, 1 genus 1 species, 1 forma of Coniferophyta were endemic to Jeju. Five families, 8 genera and 8 species in the Monocotyledonae of Endospermae and 23 families, 32 genera, 21 species, 16 varieties and 7 forma and 44 taxa in Chlopetalae, and 9 families, 24 genera, 12 species, 13 varieties and 7 forma, total 32 taxa in Sympetalae were endemic to Jeju. Total 90 taxa with 41 families, 69 genera, 46 species, 29 varieties and 15 forma were drawn up as endemic plants in Jeju. As the numbers show on, Jeju has more biodiversity especially plant diversity than any other places in Korea. It was an important region in regard to geographical position. The rarity on plants from Jeju has been assessed based on the IUCN red list categories and criteria at both regional and global levels. There was one species in each extinct (EX) and extinct in the Wild (EW). The EX and EW species were *Rhododendron saisiuense* Nakai (Ericaceae) and *Asplenium antiquum* Makino (Aspleniaceae), respectively. Three taxa, *Rhododendron dauricum* L. (Ericaceae), *Lycopodium sieboldii* Miq., and *Lycopodiella cernua* (L.) Serm (Lycopodiaceae) were species that is extinct in the region (RE). Sixty-one taxa were critically endangered (CR), 13 were endangered (EN), and 83 were vulnerable (VU) at regional level. The taxa listed on a Red List corresponds 26.9% of total taxa in Jeju. At global level, there were 19 taxa in CR, 4 in EN, and 1 in VU (Vulnerable) as the category of threat. The rest taxa (133 taxa) were classified as Least Concern (LC). According to the results of the assessment, conservation measures must be taken for total of 157 species that were categorized in threaten including one of EX, one of EW and three extinct in the region immediately. Of 157 species, 61 were CR, 13 are EN and 83 were VU.

Key words - vascular plants, Jeju, endemic plants, rare plants, IUCN, red list

Introduction

Jeju is a volcanic island that covers an area of 1,848 km² and lies in southwestern sea of Korean peninsula and the north of East China Sea (Fig. 1). Hallasan Mountain, 1,950 m high, dominated in center of the island. It has been a most interesting research site for plants because of its richness and unique biogeographic feature. The Island is classified as belonging to the East Asiatic floristic region of the Holarctic floristic kingdom. Furthermore, given its unique geographical and geological location, it is also classified as the East Siberian floristic region, in addition to serving as a boundary that begins to exhibit features of the Indo-Malaysian sub-kingdom.

Consequently, the flora of Jeju was derived from greatly divergent floristic kingdoms. Some traveled southward from



Fig. 1. The location of Jeju Island.

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the main continent; others survived on a long and narrow journey from China, Jeju and Japan; some were originated from tropical and subtropical zones; some were evolved from the flora of Jeju, Taiwan and Japan. As such, distributed on a relatively small area, the flora of Jeju exhibits astoundingly diverse traits and characteristics.

In this report, the status of vascular plants distributed in Jeju, Korea was summarized. To obtain the list, specimens, photos or descriptions were examined in 18 herbariums, Warm-Temperate Forest Research Center of Korea Forest Research Institute (WTFRC), Kangwon National Univ. (KWNA), Kyeongbuk National Univ. (KBNA), Gyeongsang Natioanal Univ. (GSNA), Korea Univ. (KUSA), Korea National Arboretum (KNKA), Taejeon Univ. (TUT), Pusan National Univ. (PSNA), Seoul National Univ. For. Coll. (SNFA), Seoul National Univ. (SNBA), Seonkkyungwan Univ. (SKKA), Sooncheon National Univ. (SCNA), Natural Museum of Ewha Univ. (ENHA), Ewha Univ. (EWUA),

Cheonbuk National Univ. (CBBA), Cheju National Univ. (CJUA), Chungbuk Natioanal Univ. (CBUA), and Hongneung Arboretum (KNHA), and published literatures (Lee, 1996; Koh, 1999; Kim, 2005, 2006a, 2006b, 2006c; Kim *et al.* 2006a, 2006b).

Flora of Jeju Island

The vascular plants in Jeju were found that 21 families 62 genera, 190 species, 7 varieties with 197 taxa in Pteridophyta, 3 families 5 genera, 7 species, 3 forma with 10 taxa in gymnosperm (Coniferophyta) and 143 families 703 genera, 1,622 species, 114 varieties and 47 forma with 1,783 taxa in Endospermae exist. The total number of taxa was 1,990 representing 167 families, 770 genera, 1,818 species, 121 varieties and 50 forma (Table 1). It included endemic plants in Jeju, 22 families 69 genera, 87 species, 3 varieties and 3 cultivars with 197 taxa, and naturalized plants, 45 families 154 genera, 246 species, 5 varieties with 251 taxa (Park *et al.*,

Table 1. Summarized table of Jeju flora

	Family	Genera	Species	Variety	formas	Total
Pteridophyta	21	62	190	7	-	197
Coniferophyta	3	5	7	-	3	10
Endospermae	143	703	1,622	114	47	1,783
Monocotyledoneae	25	197	455	24	13	492
Dicotyledoneae	118	506	1,167	90	34	1,291
Total	167	770	1,819	121	50	1,990

Table 2. Statistics of the Pteridophyta in Jeju Island

Family name	Gen.	Sp.	Var.	Family name	Gen.	Sp.	Var.
Psilotaceae	1	1	-	Davalliaceae	2	2	-
Lycopodiaceae	1	8	-	Plagiogyriaceae	1	2	-
Selaginellaceae	1	3	-	Aspidiaceae	14	87	3
Isoetaceae	1	2	-	Blechnaceae	1	1	-
Equisetaceae	1	3	-	Aspleniaceae	2	17	1
Ophioglossaceae	3	6	-	Polypodiaceae	9	21	-
Osmundaceae	1	1	-	Vittariaceae	1	1	-
Schizaeaceae	1	1	-	Marsileaceae	1	1	-
Gleicheniaceae	2	3	-	Salvinaceae	1	1	-
Hymenophyllaceae	5	6	1	Azollaceae	1	2	-
Pteridaceae	12	21	2		21	62	190

2002; Kim *et al.*, 2007).

In Pteridophyta, 197 taxa with 21 families, 62 genera, 190 species and 7 varieties including Psilotaceae were distributed in Jeju (Table 2). The most dominant family was Aspidiaceae which consists of 14 genera, 87 species and 3 varieties with 90 taxa followed by Pteridaceae, 12 genera, 21 species 2 varieties of 23 taxa and Polypodiaceae, 9 genera 21 species, and Aspleniaceae, 2 genera 17 species 1 variety, and Lycopodiaceae, 1 genus 8 species. There were seven families with 1 genus and 1 species. They were Psilotaceae, Osmundaceae, Schizaeaceae, Blechnaceae, Vittariaceae, Marsileaceae, and Salviniaceae.

Three families, 5 genera, 7 species and 3 forma of gymnosperm (Coniferophyta) were found in Jeju (Table 3). *Taxus cuspidata* in Taxaceae, 2 genera and 2 species of *Torreya* including *Torreya nucifera*, *Pinus densiflora*, *Pinus thunbergii*, and *Abies koreana* in Pinaceae, and 1 genus and 2 species in

Cupressaceae were major Coniferophyta in Hallasan. Coniferophyta in Jeju were *Taxus cuspidata*, *Torreya nucifera*, *Pinus densiflora*, *Pinus thunbergii*, *Abies koreana*, *Juniperus chinensis*. var. *sargentii* and *Juniperus rigida*, and 3 subspecies in *Abies koreana*.

Monocotyledonae, which belongs to Endospermae, contained 492 taxa with 25 families, 197 genera, 455 species, 24 varieties and 13 cultivars including Typhaceae (Table 4).

Gramineae was most dominant family that consists 83 genera, 134 species, 15 varieties and 7 as with 156 taxa, which followed by Cyperaceae, 10 genera, 98 species, 4 varieties with 102 taxa, Orchidaceae, 36 genera, 66 species, 3 varieties and 1 forma with 70 taxa, Liliaceae, 22 genera, 57 species, 2 varieties and 4 forma with 63 taxa, Juncaceae, 2 genera and 15 species, Potamogetonaceae, 3 genera and 11 species, and Araceae, 3 genera, 10 species and 1 variety.

The families which consist of 1 family, 1 genus and 1 species were Typhaceae, Scheuchzeriaceae, Musaceae and Cannaceae. Just two families are native to Jeju because Cannaceae is a naturalized exotic family.

Dicotyledoneae was divided two groups, Cholibetalae and Sympetalae because many taxa were included in this. Cholibetalae contained 83 families, 301 genera, 712 species 44 varieties and 19 forma with 775 taxa representing Saururaceae (Table 5).

Table 3. Statistics of the Coniferophyta in Jeju

Family name	Genera	Species	formas
Taxaceae	2	2	-
Pinaceae	2	3	3
Cupressaceae	1	2	-
	3	5	7
			3

Table 4. Statistics of the Monocotyledonae in Jeju

Family name	Gen.	Sp.	Var.	for.	Family name	Gen.	Sp.	Var.	for.
Typhaceae	1	2	-	-	Pontederiaceae	2	2	-	-
Sparganiaceae	1	1	-	-	Juncaceae	2	15	-	-
Potamogetonaceae	3	11	-	-	Liliaceae	22	57	2	4
Zosteraceae	1	2	-	-	Agavaceae	2	2	-	-
Scheuchzeriaceae	1	1	-	-	Amarylidaceae	4	7	-	-
Alismataceae	3	5	-	-	Dioscoreaceae	1	6	-	-
Hydrocharitaceae	5	6	-	-	Iridaceae	4	8	-	-
Gramineae	83	134	15	7	Zingiberaceae	2	2	-	-
Cyperaceae	10	98	4	-	Musaceae	1	1	-	-
Araceae	3	10	-	1	Cannaceae	1	1	-	-
Lemnaceae	3	3	-	-	Burmanniaceae	1	2	-	-
Eriocaulaceae	1	7	-	-	Orchidaceae	36	66	3	1
Commelinaceae	4	6	-	-		25	197	455	24
									13

Table 5. Statistics of the Chloipetalae subclass of the Dicotyledoneae in Jeju

Family name	Gen.	Sp.	Var.	for.	Family name	Gen.	Sp.	Var.	for.	
Saururaceae	2	2	-	-	Oxalidaceae	1	6	-	-	
Piperaceae	1	1	-	-	Linaceae	1	1	-	-	
Chloranthaceae	1	4	-	-	Zygophyllaceae	1	1	-	-	
Salicaceae	1	9	-	-	Rutaceae	5	10	-	1	
Myricaceae	1	1	-	-	Simaroubaceae	1	1	-	-	
Juglandaceae	1	1	-	-	Meliaceae	1	1	-	-	
Betulaceae	4	9	1	-	Polygalaceae	1	1	-	-	
Fagaceae	2	10	3	-	Euphorbiaceae	9	19	-	-	
Ulmaceae	4	7	1	-	Callitrichaceae	1	2	-	-	
Moraceae	5	7	3	2	Buxaceae	1	1	-	-	
Cannabinaceae	1	1	-	-	Empetraceae	1	1	-	-	
Urticaceae	7	21	1	-	Anacardiaceae	1	5	-	-	
Santalaceae	1	2	-	-	Aquifoliaceae	1	5	-	1	
Loranthaceae	3	4	-	1	Celastraceae	2	9	3	2	
Aristolochiaceae	1	3	-	-	Staphyleaceae	2	2	-	-	
Polygonaceae	7	40	2	-	Aceraceae	1	7	-	-	
Chenopodiaceae	5	12	-	-	Sapindaceae	1	1	-	-	
Amaranthaceae	3	11	-	-	Sabiaceae	1	2	-	-	
Nictaginaceae	1	1	-	-	Balsaminaceae	1	4	-	-	
Phytolaccaceae	1	2	-	-	Rhamnaceae	4	5	-	-	
Aizoaceae	2	2	-	-	Vitaceae	4	6	-	-	
Portulacaceae	1	1	-	-	Elaeocarpaceae	1	1	-	-	
Caryophyllaceae	10	28	-	2	Tiliaceae	4	5	-	1	
Nymphaeaceae	2	2	-	-	Malvaceae	6	13	-	-	
Ceratophyllaceae	1	1	-	-	Sterculiaceae	1	1	-	-	
Ranunculaceae	15	42	-	1	Actinidiaceae	1	4	-	-	
Lardizabalaceae	2	2	-	-	Theaceae	4	5	1	1	
Berberidaceae	1	1	-	-	Hypericaceae	2	6	-	-	
Menispermaceae	4	4	-	-	Violaceae	1	20	2	1	
Magnoliaceae	4	5	-	-	Flacourtiaceae	2	2	-	-	
Illiciaceae	1	1	-	-	Opuntiaceae	1	1	-	-	
Lauraceae	6	12	-	-	Thymeleaceae	3	4	-	-	
Papaveraceae	1	2	-	-	Elaeagnaceae	1	5	2	-	
Fumariaceae	1	10	1	-	Lythraceae	3	5	-	-	
Cruciferae	18	34	2	-	Alangiaceae	1	1	-	-	
Crassulaceae	3	19	-	-	Hydrocaryaceae	1	2	-	-	
Saxifragaceae	9	20	1	-	Onagraceae	4	11	2	-	
Pittosporaceae	1	1	-	-	Halorrhagaceae	2	2	-	-	
Hamamelidaceae	1	2	-	-	Araliaceae	7	9	-	-	
Rosaceae	19	62	11	2	Umbelliferae	28	43	3	1	
Leguminosae	29	67	4	2	Cornaceae	2	4	-	-	
Geraniaceae	2	12	1	1		83	301	712	44	19

The most dominant family was Rosaceae which consists of 19 genera, 62 species, and 11 varieties with 75 taxa. The next was Leguminosae, 29 genera, 67 species, 4 varieties 2 forma with 73 taxa, followed by Umspeciesiferae, 28 genera 43 species 3 varieties and 1 forma with 47 taxa, Ranunculaceae, 15 genera 42 species 1 forma with 43 taxa, Polygonaceae, 7 genera, 40 species and 2 varieties with 42 taxa, Cruciferae, 18 genera 34 species and 2 varieties with 36 taxa, Caryophyllaceae, 10 genera, 28 species and 2 varieties with 30 taxa, and Violaceae, 1 genera, 20 species, 2 varieties and 1 forma with 23 taxa.

Twenty two families, Piperaceae, Myricaceae, Juglandaceae, Cannabinaceae, Nictaginaceae, Portulacaceae, Ceratophyllaceae, Berberidaceae, Illiciaceae, Pittosporaceae, Linaceae, Zygophyllaceae, Simaroubaceae, Meliaceae, Polygalaceae, Buxaceae, Empetraceae, Sapindaceae, Elaeocarpaceae, Sterculiaceae, Opuntiaceae, Alangiaceae had only 1 genus and 1 species. Among these, Nictaginaceae, Phytolaccaceae and Sterculiaceae are naturalized exotic species; therefore only 19 families were native to Jeju.

Sympetalae in Dicotyledoeae consists of 35 families, 205

genera, 454 species, 46 varieties and 15 forma with 515 taxa including Diapensiaceae (Table 6).

Compositae was most dominant family as of 184 taxa with 67 genera, 166 species, 13 varieties, 5 forma. Laviatae followed as consisting of 22 genera, 43 species, 11 varieties, 3 forma with total of 57 taxa. Scrophulariaceae, 16 genera, 27 species, 5 varieties with 32 taxa, Rubiaceae, 9 genera, 25 species, 3 varieties and 1 forma with 29 taxa, Solanaceae, 8 genera, 19 species and 1 variety with 20 taxa, Caprifoliaceae, 4 genera, 19 species and 2 varieties with 21 taxa, and Convolvulaceae, 5 genera, 14 species, 1 variety with 15 taxa. The families with 1 genus and 1 species were Diapensiaceae, Cletheraceae, Plumbaginaceae, Bignoniaceae, Phrymaceae, Adoxaceae, Dipsacaceae. Six of these families are native to Jeju and Bignoniaceae is a naturalized exotic family.

Endemic to Jeju Island

Three families, 4 genera 4 species and 1 variety in Pteridophyta and 1 family, 1 genus 1 species, 1 forma of Coniferophyta were endemic to Jeju. Five families, 8 genera and 8

Table 6. Statistics of the Sympetalae subclass of the Dicotyledoeae in Jeju

Family name	Gen.	Sp.	Var.	for.	Family name	Gen.	Sp.	Var.	for.
Diapensiaceae	1	1	-	-	Solanaceae	8	19	1	-
Cletheraceae	1	1	-	-	Scrophulariaceae	16	27	5	-
Pyrolaceae	4	4	-	-	Bignoniaceae	1	1	-	-
Ericaceae	2	11	-	3	Orobanchaceae	3	3	-	-
Myrsinaceae	1	3	-	-	Lentibulariaceae	1	3	-	-
Primulaceae	4	13	1	-	Acanthaceae	3	3	-	-
Plumbaginaceae	1	1	-	-	Phrymaceae	1	1	-	-
Symplocaceae	1	5	-	-	Plantaginaceae	1	6	-	-
Styracaceae	1	2	-	-	Rubiaceae	9	25	3	1
Oleaceae	4	10	1	1	Caprifoliaceae	4	19	2	-
Loganiaceae	2	2	-	-	Adoxaceae	1	1	-	-
Gentianaceae	4	10	1	-	Valerianaceae	2	3	1	-
Apocynaceae	4	5	1	-	Dipsacaceae	1	1	-	-
Asclepiadaceae	4	9	1	-	Cucurbitaceae	7	7	1	-
Convolvulaceae	5	14	1	-	Campanulaceae	6	13	-	1
Borraginaceae	7	12	1	-	Lobeliaceae	1	2	-	-
Verbenaceae	5	8	2	1	Compositae	67	166	13	5
Laviatae	22	43	11	3	35	205	454	46	15

Table 7. The list of 90 endemic vascular taxa of Jeju

No.	Scientific name (Family name)
1	<i>Lycopodium integrifolium</i> Matsuda & Nakai (Lycopodiaceae)
2	<i>Mankyua chejuense</i> B.-Y. Sun, M. H. Kim & C. H. Kim. (Ophioglossaceae)
3	<i>Polystichum cystolepidotum</i> Franch. (Aspidiaceae)
4	<i>Asplenium curtidentis</i> (Christ) Koidz. (Aspleniaceae)
5	<i>Asplenium sarelii</i> var. <i>anogrammoides</i> (H.Christ) Tagawa (Aspleniaceae)
6	<i>Abies koreana</i> for. <i>rubrocarpa</i> T. Lee (Pinaceae)
7	<i>Agropyron ciliare</i> for. <i>pilosum</i> T. Lee. (Gramineae)
8	<i>Pseudosasa japonica</i> var. <i>purpurascens</i> Nakai (Gramineae)
9	<i>Eriocaulon glaberimum</i> var. <i>platypetalum</i> (Satake) Satake (Eriocaulaceae)
10	<i>Polygonatum odoratum</i> var. <i>quelpartense</i> Hara (Liliaceae)
11	<i>Lycoris chejuensis</i> K.Tae & S.Ko (Amarylidaceae)
12	<i>Calanthe coreana</i> Nakai (Orchidaceae)
13	<i>Diplolabellum coreanum</i> (Finet) Maekawa (Orchidaceae)
14	<i>Habenaria chejuensis</i> Y. Lee & K. Lee (Orchidaceae)
15	<i>Salix blinii</i> Lev. (Salicaceae)
16	<i>Corylus hallaisanensis</i> Nakai (Betulaceae)
17	<i>Quercus glauca</i> var. <i>nudata</i> Blume (Fagaceae)
18	<i>Celtis jessoensis</i> var. <i>angustifolia</i> Nakai (Ulmaceae)
19	<i>Boehmeria hirtella</i> Satake (Urticaceae)
20	<i>Boehmeria nakaiana</i> Satake (Urticaceae)
21	<i>Boehmeria taquetii</i> Nakai (Urticaceae)
22	<i>Silene fasciculata</i> Nakai (Caryophyllaceae)
23	<i>Aconitum quelpaertense</i> Nakai (Ranunculaceae)
24	<i>Ranunculus crucilobus</i> Lev. (Ranunculaceae)
25	<i>Berberis amurensis</i> Rupr. var. <i>quelpartensis</i> Nakai (Berberidaceae)
26	<i>Cinnamomum camphora</i> var. <i>cyclophyllum</i> Nakai (Lauraceae)
27	<i>Arabis serrata</i> var. <i>hallasanensis</i> (Nakai) Ohwi (Cruciferae)
28	<i>Cardamine impatiens</i> var. <i>fumariae</i> Lev. (Cruciferae)
29	<i>Sedum viridescens</i> Nakai (Crassulaceae)
30	<i>Astilbe taquetii</i> (Lev.) Koidz. (Saxifragaceae)
31	<i>Chrysosplenium hallaisanense</i> Nakai (Saxifragaceae)
32	<i>Distylium racemosum</i> var. <i>latifolia</i> Nakai (Hamamelidaceae)
33	<i>Aruncus dioicus</i> var. <i>aethussifolia</i> (Lev.) Hara (Rosaceae)
34	<i>Prunus hallasanensis</i> C.Kim & M.Kim (Rosaceae)
35	<i>Prunus jamasakura</i> for. <i>densifolia</i> (Keohne) W. Lee (Rosaceae)
36	<i>Prunus jamasakura</i> var. <i>quelpaertensis</i> (Nakai) Uyeki (Rosaceae)
37	<i>Prunus longistylus</i> C.Kim & M.Kim (Rosaceae)
38	<i>Prunus yedoensis</i> Matsumura var. <i>yedoensis</i> (Rosaceae)
39	<i>Prunus yedoensis</i> var. <i>angustipetala</i> C.Kim & M.Kim (Rosaceae)
40	<i>Rubus hirsutus</i> for. <i>argyi</i> (Lev.) W.Lee (Rosaceae)
41	<i>Rubus hongnoensis</i> Nakai (Rosaceae)
42	<i>Rubus schyzostylus</i> Lev. (Rosaceae)
43	<i>Rubus sumatranus</i> var. <i>myriadenus</i> (Lev. & Vant.) W.Lee (Rosaceae)
44	<i>Astragalus nkaianus</i> Y. Lee (Leguminosae)
45	<i>Trifolium lupinaster</i> L. for. <i>alpinus</i> (Nakai) M.Park (Leguminosae)

Table 7. The list of 90 endemic vascular taxa of Jeju (Continued)

No.	Scientific name (Family name)
46	<i>Vicia unijuga</i> for. <i>minor</i> Nakai (Leguminosae)
47	<i>Geranium shikokianum</i> var. <i>quelpartensis</i> Nakai (Geraniaceae)
48	<i>Zanthoxylum piperitum</i> for. <i>pubescens</i> (Nakai) W.Lee (Rutaceae)
49	<i>Euphorbia octoradiata</i> Lev. & Vaniot (Euphorbiaceae)
50	<i>Euphorbia pekinensis</i> var. <i>fauriei</i> (Lev. & Vaniot) Hurusawa (Euphorbiaceae)
51	<i>Euonymus flavescens</i> Nakai (Celastraceae)
52	<i>Euonymus quelpartensis</i> Nakai (Celastraceae)
53	<i>Impatiens aphanantha</i> Hook. fil. (Balsaminaceae)
54	<i>Rhamnus taquetii</i> Lev. (Rhamnaceae)
55	<i>Grewia parviflora</i> for. <i>angusta</i> (Nakai) W.Lee (Tiliaceae)
56	<i>Angelica polymorpha</i> var. <i>fallax</i> (Boissieu) Kitagawa (Umbelliferae)
57	<i>Bupleurum longiradiatum</i> for. <i>leveillei</i> (Boissieu) Kitagawa (Umbelliferae)
58	<i>Pimpinella brachycarpa</i> var. <i>hallaisanensis</i> W.Lee & G.Jang (Umbelliferae)
59	<i>Rhododendron saisuiense</i> Nakai (Ericaceae)
60	<i>Chionanthus retusa</i> var. <i>coreana</i> (Lev.) Nakai (Oleaceae)
61	<i>Callicarpa chejuensis</i> Chung & Kim. (Verbenaceae)
62	<i>Elsholtzia pseudo-cristata</i> for. <i>minima</i> (Nakai) Kitagawa (Labiatae)
63	<i>Elsholtzia hallasanensis</i> Y. Lee (Labiatae)
64	<i>Plectranthus inflexus</i> var. <i>canescens</i> Nakai (Labiatae)
65	<i>Scutellaria indica</i> var. <i>alba</i> S.Kim & S.Lee (Labiatae)
66	<i>Scutellaria indica</i> var. <i>coccinea</i> S. Kim & S. Lee (Labiatae)
67	<i>Euphrasia coreana</i> W. Becker (Scrophulariaceae)
68	<i>Melampyrum roseum</i> var. <i>ovalifolium</i> for. <i>albiflorum</i> Nakai ex T. Lee (Scrophulariaceae)
69	<i>Pedicularis hallasanensis</i> Hurusawa (Scrophulariaceae)
70	<i>Scrophularia buergeriana</i> var. <i>quelpartensis</i> Yamazaki (Scrophulariaceae)
71	<i>Scrophularia kakudensis</i> var. <i>microphylla</i> Nakai (Scrophulariaceae)
72	<i>Veronica linariaefolia</i> var. <i>villosula</i> (Nakai) T.Lee (Scrophulariaceae)
73	<i>Galium verum</i> var. <i>asiaticum</i> for. <i>pusillum</i> Nakai (Rubiaceae)
74	<i>Valeriana fauriei</i> var. <i>coreana</i> (Briquet) Hara (Valerianaceae)
75	<i>Adenophora palustris</i> for. <i>leucantha</i> Nakai (Campanulaceae)
76	<i>Codonopsis minima</i> Nakai (Campanulaceae)
77	<i>Artemisia japonica</i> var. <i>hallasanensis</i> (Nakai) Kitamura (Compositae)
78	<i>Aster chejuensis</i> (Kitamura) Nakai (Compositae)
79	<i>Aster hayatae</i> Lev. & Vaniot (Compositae)
80	<i>Aster magnus</i> for. <i>albiflorus</i> Y.Lee & C.Kim (Compositae)
81	<i>Aster magnus</i> Y.Lee & C.Kim for. <i>magnus</i> (Compositae)
82	<i>Aster scaber</i> var. <i>minor</i> Yabe ex Nakai (Compositae)
83	<i>Cirsium rhinoceros</i> Nakai for. <i>rhinoceros</i> (Compositae)
84	<i>Cirsium rhinoceros</i> for. <i>albiflorum</i> Sakata & Nakai (Compositae)
85	<i>Crepidiastrum hallasanense</i> (H. Lev.) J.-H. Pak. (Compositae)
86	<i>Kalimeris chejuensis</i> Kim & Chung (Compositae)
87	<i>Leontopodium hallasanense</i> Hand.-Mazz. (Compositae)
88	<i>Saussurea maximowizii</i> var. <i>triceps</i> (Lev. & Vaniot) Kitamura (Compositae)
89	<i>Serratula cornata</i> L. var. <i>alpina</i> Nakai (Compositae)
90	<i>Taraxacum hallasanensis</i> Nakai (Compositae)

species in the Monocotyledonae of Endospermae and 23 families, 32 genera, 21 species, 16 varieties and 7 forma, total 44 taxa in Chloipetalae, and 9 families, 24 genera, 12 species, 13 varieties and 7 forma, total 32 taxa in Sympetalae were endemic to Jeju. Total 90 taxa with 41 families, 69 genera, 46 species, 29 varieties and 15 forma were drawn up as endemic plants in Jeju (Table 7).

The families having large numbers of endemic plants were Compositae (14 taxa), Rosaceae (11 taxa), Scrophulariaceae (6 taxa), Laviatae (5 taxa.) and 3 species of Orchidaceae, Urticaceae, Leguminosae and Umbelliferae respectively. Sorting by genus, *Prunus* (6 taxa), *Aster* (6 taxa), *Rubus* (4 taxa) and *Boehmeria* (3 taxa) were in order. Endemic plants were diverse on the families and genera. Although the numbers or size of populations was small, only few of endemic plants were listed on Red Data Book (IUCN, 2006). In order to protect the endemic plant resources from the global warming and civilizations by humans, conservation efforts were required (Kim, 2002; Kong, 1998).

Rare plants

The rarity on plants from Jeju has been assessed based on the IUCN red list categories and criteria at both regional and global levels (IUCN, 2003, 2006; Kim *et al.*, 2007). The objective data from the assessment will be useful for establishing policy on endangered flora and conducting environment impact assessment.

As results, at regional level, there was one taxon in Extinct (EX), one in Extinct in the Wild (EW), 3 in Extinct in the Region (RE), 61 in Critically Endangered (CR), 13 in Endangered (EN), 83 in Vulnerable (VU), and 374 in Near Endangered (NE). The rest taxa fall in Least Concern (LC) and in Data Deficient (DD) (Table 8).

The taxa listed on a Red List corresponds 26.9% of total taxa (1,990) in Jeju. It was higher than that of Japan, which was 24%.

With the evaluations at the level of region, there were total of 536 taxa as the Red Lists that represent 1 of Extinct, 1 of Extinct in the Wild, 3 of Extinct in the Region, 61 of Critically Endangered, 13 of Endangered, 83 of Vulnerable, and 374 of Near Threatened. The taxa, which were required immediate conservation actions by the authorities in Jeju, were total of 157 that were classified as the categories of Critically Endangered (61), Endangered (13), and Vulnerable (83).

Followed species were classified as the category of Critically Endangered at global level; *Isoetes sinensis* Palmer, *Mankyua chejuense* B. Y. Sun, M. H. Kim & C. H. Kim, *Silene fasciculata* Nakai, *Prunus hallasanensis* Chan S. Kim & M. Kim, *Prunus longistylus* Chan S. Kim & M. Kim, *Prunus yedoensis* Matsumura var. *yedoensis*, *Prunus yedoensis* var. *angustipetala* Chan S. Kim & M. Kim, *Orobanche filicicola* Nakai, *Leontopodium hallasanense* Hand.-Mazz., *Oreorchis coreana* Finet. These ten species were also classified as the same category at global level. The endangered species was *Eleutherococcus divaricatus* var. *chiisanensis* (Nakai) C.H. Kim & B.Y.Sun.

Eight species of ten in endangered at regional level were classified as critically endangered species at global level. These were *Salix blinii* Lev., *Arabis serrata* var. *hallasanensis* (Nakai) Ohwi, *Astragalus nakaianus* Y.N.Lee, *Rhamnus taquetii* (Lev.) Lev., *Pedicularis hallasanensis* Hurusawa, *Dendranthema coreanum* (H. Lev. & Vaniot) Vorosch. and *Lycoris chejuensis* K.Tae & S.Ko. Two of them were also classified as endangered at global level. These were *Asarum misandrum* B.Oh & J.Kim and *Megaleranthis saniculifolia* Ohwi.

One species in category of Vulnerable at regional level, *Euphrasia coreana* W. Becker was critically endangered at global level and the other, *Salix hallaisanensis* Lev., was endangered species at global level.

When 157 taxa evaluated as Red Lists at regional level

Table 8. Summary of number of species in each Red List category

Extinct (EX)	Extinct in the Wild (EW)	Extinct in the Region (RE)	Critically Endangered (CR)	Endangered (EN)	Vulnerable (VU)	Near Threatened (NT)	Least Concern (LC)	Data Deficient (DD)
1	1	3	61	13	83	374	907	526

were classified again at global level, 19 were critically endangered, 4 were endangered, 1 was vulnerable, and the rest were least concern (Table 9).

Conservation actions must be taken immediately for the species that were classified as critically endangered (61), endangered (13) and vulnerable (83) (Table 10).

Adopting the policy to protect wild fauna and flora will be appropriate to protect the species in the Red List. For example, the critically endangered and endangered species are regarded as the first class of endangered species, and the vulnerable species are regarded as the second class.

Table 9. Number of species in each Red List Category using standard of IUCN

Critically Endangered	Endangered	Vulnerable	Least Concern	Total
19	4	1	133	157

Table 10. Red list by category using regional level standard of IUCN from Jeju Island

Family	Species name	Global level
CR		
Isoeteaceae	<i>Isoetes sinensis</i> Palmer	CR
Psilotaceae	<i>Psilotum nudum</i> (L.) P. Beauv.	LC
Ophioglossaceae	<i>Mankyua chejuense</i> B. Y. Sun, M. H. Kim & C. H. Kim	CR
Aspleniaceae	<i>Asplenium tripteropus</i> Nakai	LC
	<i>Asplenium wrightii</i> D. C. Eaton ex Hook.	LC
Blechnaceae	<i>Woodwardia japonica</i> (L. f.) Sm.	LC
Athyriaceae	<i>Athyrium epirachis</i> (H. Christ) Ching	LC
	<i>Athyrium iseanum</i> Rosenst.	LC
	<i>Deparia viridifrons</i> (Makino) M. Kato	LC
	<i>Diplazium hachijoense</i> Nakai	LC
Dryopteridaceae	<i>Arachniodes simplicior</i> (Makino) Ohwi	LC
	<i>Dryopteris subexaltata</i> (H. Christ) C. Chr.	LC
Nephrolepidaceae	<i>Nephrolepis cordifolia</i> (L.) C. Presl	LC
Polypodiaceae	<i>Crypsinus veitchii</i> (Bak.) Copel.	LC
	<i>Microsorium buergerianum</i> (Miq) Ching	LC
	<i>Colysis simplicifrons</i> (H. Christ) Tagawa	LC
Magnoliaceae	<i>Michellia compressa</i> (Maxim.) Sarg.	LC
Chloranthaceae	<i>Chloranthus glaber</i> (Thunb.) Makino	LC
Saururaceae	<i>Saururus chinensis</i> (Lour.) Baillon	LC
Cabombaceae	<i>Brasenia schreberi</i> J.F.Gmel.	LC
Urticaceae	<i>Oreocnide frutescens</i> (Thunb.) Miq.	LC
Fagaceae	<i>Quercus gilva</i> Blume	LC
Caryophyllaceae	<i>Silene fasciculata</i> Nakai	CR
Diapensiaceae	<i>Diapensia lapponica</i> L. var. <i>obovata</i> Fr. Schmidt	LC
Maesaceae	<i>Maesa japonica</i> (Thunb.) Moritz & Zoll.	LC
Hydrangeaceae	<i>Hydrangea luteovenosa</i> Koidz.	LC
Crassulaceae	<i>Sedum tosaense</i> Makino	LC
Rosaceae	<i>Prunus hallasanensis</i> C.Kim & M.Kim	CR
	<i>Prunus longistylus</i> C.Kim & M.Kim	CR
	<i>Prunus yedoensis</i> Matsumura var. <i>yedoensis</i>	CR
	<i>Prunus yedoensis</i> var. <i>angustipetala</i> C.Kim & M.Kim	CR
	<i>Amelanchier asiatica</i> (Sieb. & Zucc.) Endl.	LC

Table 10. Red list by category using regional level standard of IUCN from Jeju Island (Continued)

Family	Species name	Global level
Fabaceae	<i>Euchresta japonica</i> Benth.	LC
Araliaceae	<i>Eleutherococcus divaricatus</i> var. <i>chiisanensis</i> (Nakai) C.H.kim & B.Y.Sun	EN
Oleaceae	<i>Osmanthus insularis</i> Koidz.	LC
Orobanchaceae	<i>Orobanche filicicola</i> Nakai	CR
Lentibulariaceae	<i>Urticularia yakusimensis</i> Masamune	LC
Rubiaceae	<i>Lasianthus japonicus</i> Miq.	LC
Asteraceae	<i>Leontopodium hallasanense</i> Hand.-Mazz.	CR
Alismataceae	<i>Caldesia parnassifolia</i> (Bassi ex L.) Parl.	LC
Burmanniaceae	<i>Burmannia cryptopetala</i> Makino	LC
Orchidaceae	<i>Coeloglossum viride</i> var. <i>virescens</i> (Muhl. ex Willd.) Luer	LC
	<i>Gastrodia pubilabiata</i> Sawa	LC
	<i>Cyrtosia septentrionalis</i> (Rchb. f.) Garay	LC
	<i>Neottia hypocastanoptica</i> Y. N. Lee	LC
	<i>Chamaegastrodia shikokiana</i> Makino & F. Maek.	LC
	<i>Vexillabium yakusimense</i> var. <i>nakaianum</i> (F. Maek.) T. B. Lee	LC
	<i>Oberonia japonica</i> (Maxim.) Makino	LC
	<i>Oreorchis coreana</i> Finet	CR
	<i>Liparis auriculata</i> Blume ex Miq.	LC
	<i>Cremastra unguiculata</i> (Finet) Finet	LC
	<i>Dendrobium moniliforme</i> (L.) Sw.	LC
	<i>Bulbophyllum drymoglossum</i> Maxim.	LC
	<i>Bulbophyllum inconspicuum</i> Maxim.	LC
	<i>Cymbidium kanran</i> Makino	LC
	<i>Cymbidium lancifolium</i> Hook.	LC
	<i>Cymbidium macrohizon</i> Lindl.	LC
	<i>Cleisostoma scolopendrifolium</i> (Makino) Garay	LC
<i>Neofinetia falcata</i> (Thunb.) Hu	LC	
<i>Thrixspermum japonicum</i> (Miq.) Rchb. f.	LC	
<i>Nervilia nipponica</i> Makino	LC	
EN		
Aspleniaceae	<i>Asplenium prolongatum</i> Hook.	LC
Thelypteridaceae	<i>Cyclosorus interruptus</i> (Willd.) H. Ito	LC
Loxogrammeaceae	<i>Loxogramme salicifolia</i> (Makino) Makino	LC
Aristolochiaceae	<i>Asarum misandrum</i> B.Oh & J.Kim	EN
Ranunculaceae	<i>Megaleranthis saniculifolia</i> Ohwi	EN
Salicaceae	<i>Salix blinii</i> Lev.	CR
Brassicaceae	<i>Arabis serrata</i> var. <i>hallasanensis</i> (Nakai) Ohwi	CR
Fabaceae	<i>Astragalus nakaianus</i> Y.N.Lee	CR
Rhamnaceae	<i>Rhamnus taquetii</i> (Lev.) Lev.	CR
Scrophulariaceae	<i>Pedicularis hallasanensis</i> Hurusawa	CR
Campanulaceae	<i>Codonopsis minima</i> Nakai	CR
Asteraceae	<i>Dendranthema coreanum</i> (H. Lev. & Vaniot) Vorosch.	CR
Amaryllidaceae	<i>Lycoris chejuensis</i> K.Tae & S.Ko	CR
VU		
Lycopodiaceae	<i>Huperzia cryptomeriana</i> (Maxim.) R. D. Dixit	LC
Selaginellaceae	<i>Selaginella helvetica</i> (L.) Link	LC
Plagiogyriaceae	<i>Plagiogyria japonica</i> Nakai	LC

Table 10. Red list by category using regional level standard of IUCN from Jeju Island (Continued)

Family	Species name	Global level
Adiantaceae	<i>Adiantum pedatum</i> L.	LC
Vittariaceae	<i>Haplopteris flexuosa</i> (Fee) E. H. Crane	LC
Pteridaceae	<i>Pteris cretica</i> L. var. <i>albolineata</i> Hook.	LC
	<i>Cheilanthes chusana</i> Hook.	LC
Aspleniaceae	<i>Asplenium scolopendrium</i> L.	LC
	<i>Asplenium trichomanes</i> L.	LC
	<i>Asplenium unilaterale</i> Lam.	LC
Woodsiaceae	<i>Woodsia manchuriensis</i> Hook.	LC
Athyriaceae	<i>Deparia okuboana</i> (Makino) M. Kato	LC
	<i>Diplazium nipponicum</i> Tagawa	LC
	<i>Diplazium wichurae</i> (Mett.) Diels	LC
Thelypteridaceae	<i>Phegopteris connectilis</i> (Michx.) Watt	LC
	<i>Thelypteris quelpaertensis</i> (H. Christ) Ching	LC
	<i>Pseudocyclosorus subochthodes</i> (Ching) Ching	LC
	<i>Cyclosorus dentatus</i> (Forssk.) Ching	LC
Dryopteridaceae	<i>Polystichum craspedosorum</i> (Maxim.) Diels	LC
	<i>Arachniodes amabilis</i> (Blume) Tindale	LC
	<i>Dryopteris dickinsii</i> (Franch. & Sav.) C. Chr.	LC
	<i>Dryopteris expansa</i> (C. Presl) Fraser-Jenk. & Jermy	LC
	<i>Dryopteris formosana</i> (H. Christ) C. Chr.	LC
Loxogrammeaceae	<i>Loxogramme grammitoides</i> (Bak.) C. Chr.	LC
	<i>Loxogramme duclouxii</i> H. Christ	LC
Polypodiaceae	<i>Pyrrosia davidii</i> (Baker) Ching	LC
Myricaceae	<i>Myrica rubra</i> Siebold & Zucc.	LC
Betulaceae	<i>Carpinus turczaninowii</i> Hance	VU
Polygonaceae	<i>Polygonum chinense</i> L.	LC
Actinidiaceae	<i>Actinidia rufa</i> (Sieb. & Zucc.) Planch.	LC
Elaeocarpaceae	<i>Elaeocarpus syvestris</i> var. <i>ellipticus</i> (Thunb.) Hara	LC
Tiliaceae	<i>Grewia parviflora</i> Bunge	LC
Malvaceae	<i>Hibiscus hamabo</i> Sieb. & Zucc.	LC
Salicaceae	<i>Salix hallaisanensis</i> Lev.	EN
Brassicaceae	<i>Cardamine tanakae</i> Franch. & Sav.	LC
	<i>Sisymbrium luteum</i> (Maxim.) O.E.Schulz	LC
Ericaceae	<i>Vaccinium uliginosum</i> L.	LC
Primulaceae	<i>Lysimachia davurica</i> Ledeb.	LC
	<i>Lysimachia leucantha</i> Miq.	LC
Rosaceae	<i>Rhodotypos scandens</i> (Thunb.) Makino	LC
	<i>Rubus sorbifolius</i> Maxim.	LC
Fabaceae	<i>Canavalia lineata</i> (Thunb.) DC.	LC
Thymelaeaceae	<i>Daphne kiusiana</i> Miq.	LC
	<i>Stellera chamaejasme</i> L.	LC
Buxaceae	<i>Buxus koreana</i> (Nakai ex Rehder) T. H. Chung, P. S. Toh, D. B. Lee & F. J. Lee	LC
Rhamnaceae	<i>Paliurus ramosissimus</i> (Lour.) Poir.	LC
Zygophyllaceae	<i>Tribulus terrestris</i> L.	LC
Araliaceae	<i>Eleutherococcus gracilistylus</i> (W.W.Sm.) S.Y.Hu	LC
Gentianaceae	<i>Nymphoides coreana</i> Hara	LC
	<i>Nymphoides indica</i> (L.) O. Kuntze	LC

Table 10. Red list by category using regional level standard of IUCN from Jeju Island (Continued)

Family	Species name	Global level
Asclepiadaceae	<i>Marsdenia tomentosa</i> Morr. & Decne.	LC
Lamiaceae	<i>Dysophylla yatabeana</i> Makino	LC
Scrophulariaceae	<i>Euphrasia coreana</i> W. Becker	CR
Orobanchaceae	<i>Phacelamthus tubiflorus</i> Sieb. & Zucc.	LC
Caprifoliaceae	<i>Lonicera caerulea</i> L. subsp. <i>edulis</i> (Turcz. ex Herder) Hulten	LC
Asteraceae	<i>Tephrosieris flammea</i> (Turcz. ex DC.) Holub	LC
Alismataceae	<i>Sagittaria aginashi</i> (Makino) Makino	LC
	<i>Sagittaria pygmaea</i> Miq.	LC
Hydrocharitaceae	<i>Ottelia alismoides</i> Pers.	LC
	<i>Blyxa aubertii</i> Rich.	LC
Juncaginaceae	<i>Triglochin maritimum</i> L.	LC
Araceae	<i>Pinellia tripartita</i> (Blume) Schott	LC
	<i>Arisaema hetrophyllum</i> Blume	LC
Poaceae	<i>Phacelurus latifolius</i> (Steud.) Ohwi	LC
Sparganiaceae	<i>Sparganium stoloniferum</i> Ham.	LC
Liliaceae	<i>Lilium concolor</i> var. <i>pulchellum</i> (Fisch.) Regel	LC
	<i>Lloydia serotinum</i> (L.) Salisb. ex Rchb.	LC
Liliaceae	<i>Tofieldia fauriei</i> Lev. & Vaniot	LC
	<i>Veratrum maackii</i> var. <i>japonicum</i> T. Shimizu	LC
	<i>Streptopus ovalis</i> (Ohwi) F. T. Wang & Y. C. Tang	LC
	<i>Polygonatum involucreatum</i> (Franch. et Sav.) Maxim.	LC
	<i>Clintonia udensis</i> Trautv. & Mey.	LC
Hypoxidaceae	<i>Hypoxis aurea</i> Lour.	LC
Iridaceae	<i>Iris minutoaurea</i> Makino	LC
Burmanniaceae	<i>Burmannia championii</i> Thwaites	LC
Orchidaceae	<i>Habenaria flagellifera</i> (Maxim.) Makino	LC
	<i>Amitostigma gracile</i> (Blume) Schltr.	LC
	<i>Platanthera mandarinorum</i> subsp. <i>maximowicziana</i> (Schltr.) K. Inoue	LC
	<i>Platanthera minor</i> Reichb. fil.	LC
	<i>Cephalanthera erecta</i> var. <i>subalphyla</i> (Miyabe & Kudo) Ohwi	LC
	<i>Pogonia japonica</i> Reichb. fil.	LC
	<i>Lecanorchis kiusiana</i> Tuyama	LC
	<i>Goodyera repens</i> (L.) R Brown	LC

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