

Dispersion of vascular plant in Daepyeong Swamp and Jilnal Swamp, Korea

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Abstract: The present study is to phytosociologically compare two swamps of Daepyeongnup Swamp (DPS) where designated as Natural Monument No 346 in 1984 and Jilnalnup Swamp (JNS), where out of legal protection at present, in Haman-gun, Gyeongsangnam-do Province, a home of the swamp in the Korean peninsula. The obtained results are summarized in the follows. For the boundary of protected swamp, only 33,911 m² out of 103,979 m² of DPS is designated as a Natural Monument No. 346, while the JNS has 177,418 m². The spatial size of the DPS is much smaller than the JNS, but the JNS is under threat from rapid land development nearby. The flora of the DPS is recorded as 116 taxa of 51 families, 98 genus, 104 species, 11 varieties and 1 form, while the JNS is recorded as 115 taxa of 50 families, 97 genus, 99 species, 16 varieties. Both endangered species of *Euryale ferox* (Nymphaeaceae) and *Hydrocharis dubia* (Hydrochariaceae) were distributed in the two swamps. The 16 taxa of naturalized plant species were recorded in the DPS, while 15 taxa of naturalized plant species were recorded in the JNS. The rate of naturalization (RN) is almost similar between two swamps; 13.8% for the DPS and 13.0% for the JNS. Also the Urbanization Index (UI) is almost similar between two swamps; 5.9% for the DPS and 5.5% for the JNS. For the pattern of the life form, the rate of an annual plant is 24% for the DPS and 31% for the JNS, respectively. With summarizing the above results, the JNS, where non-legally protected swamp, has relatively similar or the better condition of the phytosociological indicators like flora, life form, actual vegetation, green naturalness and vegetation structure. Thus, the overall phytosociological indicators of the JNS showed the conservation value compare to the DPS, where legally protecting as a Natural Monuments of Korea. The concern for the habitat conservation of the JNS, as well as the DPS, is important towards the biodiversity conservation of the degraded swamp in the context of biodiversity conservation of Korea.

Keywords: Protected areas, Natural monument, Gyeongsangnam-do

Introduction

With the Convention on Biodiversity of the Rio Summit in 1992, there has been of great concern in the importance of worldwide environmental protection. With this perspective, in South Korea, marshy lands were considered to useless, and since the 1960s, most of the area was degraded due to commercial development or developed for other reasons. Therefore, the area of marshy land decreased from 83,309 ha (833,090,000 km²) in 1910 to 75,237 ha (752,370,000 m²) in the 1970s, to 25,821 ha (258,210,000 m²) in 2000 and rapidly decreasing (Rho and Lee, 2006).

In 1971, the Ramsar Convention introduced and confirmed the importance of marshy lands in terms of ecological importance (Park *et al.*, 2000; Song and Gu, 2006). The

marshes function as the corridor connecting land ecosystem with aquatic ecosystem so has relatively high diversity.

Furthermore, marshes are high valuable in terms of cleaning up pollutions, providing habitats for various species and raising aquatic species in terms of economics (Odum, 1983; Park *et al.*, 2000; Jejudo, 2001; Lewis, 2001; Moon 2005; Mitsch and Gosselink, 2007).

South Korea, which has decided to reflect on the economical situation and the acceptance of the importance of protecting and conserving marshes, decided to be a part of the Ramsar Convention in reinterpreting the importance of domestic marshes. Along with this, environmental protection laws were revised, and on February 8th of 1999, a new legislation was placed for marsh conservation.

The back marsh which is a representative marsh is well distributed in Beobsoo-myeon of Haman-gun, and it was established as the Natural Monument No 346 to receive government protection on November 19, 1984. However, at the time it was being registered as a natural monument, the

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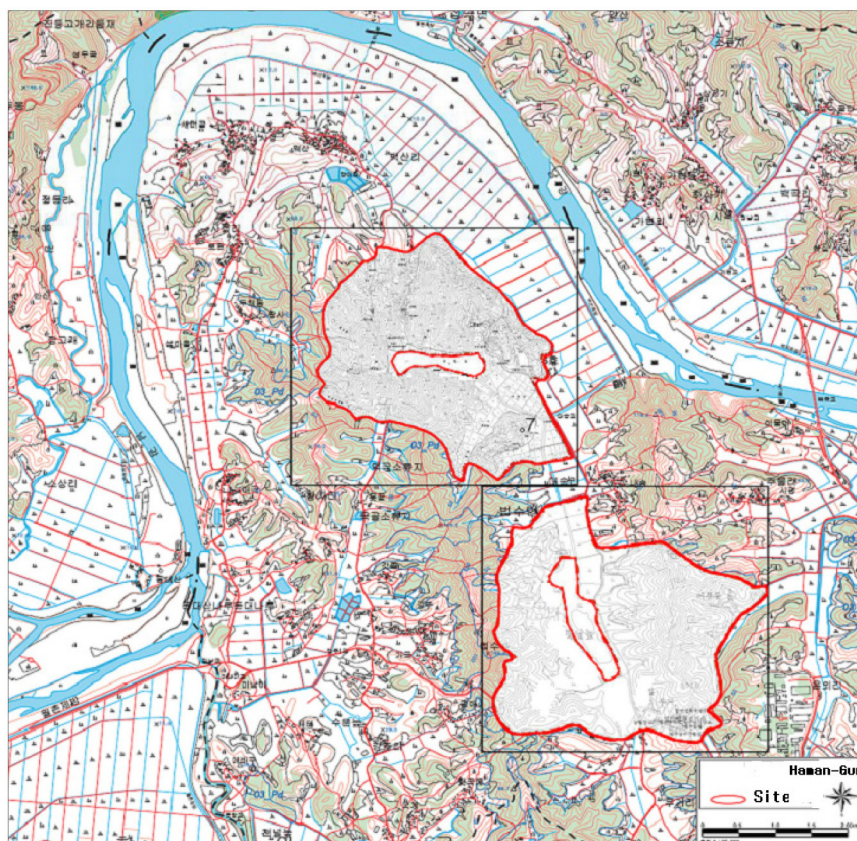


Fig. 1. Locations of vegetation study sites of daepyeong swamp and Jilnal swamp in Haman-Gun.

Cultural Properties Protection Law was applied to it, so there existed a number of problems related to the ecological management of the marsh. The marsh was already settled as a government protected region in 1984 before any specific legislation protection marshes was instilled. In 1999, marsh preservation laws were instilled to protect marsh lands and various regulations were systematically carried out, but the marsh is still under the protection of the Cultural Properties Protection Law.

With the Foxnut being chosen as a natural monument in an area close to the protected marshes, there is a need to study the plant ecology of swamps similar to protected marsh lands in terms of size and environmental properties, which are not under government protection.

Study Methods

Flora

This study was started with a preliminary study on daepyeong swamp and Jilnal swamp on October of 2006 and was conducted from March 2007 to October 2008 for field data collection. The collected field data for plant species was organized according to the Fuller & Tippo, and scientific names were enlisted (Lee Chang-Bok, 1980).

Furthermore, the Naturalization Index (NI) by Lim and

Jeon (1980) and the Urbanization Index (UI) were used as well. The UI was calculated using the equation established Park Su-Hyeon (1999) on 271 species of naturalized plants in Korea.

$$N.I. = \frac{S}{N \cdot V} \times 100(\%) , \quad U.I. = \frac{S}{N} \times 100(\%)$$

N.I.: Naturalization Index, U.I.: Urbanization Index

S: number of naturalized plant species used as subjects

N: number of naturalized plant species of South Korea

N·V: number of vascular plant species among all subjects

Life form analysis

In order to analyze the environmental factors and the plant sociology of plants near daepyeong swamp and Jilnal swamp, the vascular plants were divided into 7 categories of Phanerophytes (Ph), Chamaephytes (Ch), Hemicryptophytes (H), Geophytes (G), Therophytes (Th), Hydrophytes and Helophytes (HH) and Epiphytes (E) according to the standard established by Raunkiaer (1934).

Plant species life cycle and styles were organized using the standards established by Lee (1996). The life cycle and styles of individual categories were calculated into percentages and these figures were compared and analyzed via regions.

Results and Discussion

Flora

1) Daepyeong swamp

Between April and October of 2007, 108 species of 51 families and 98 genus, 6 variety and 2 forma were recorded for a total of 116 taxa. Among these, 4 species of 4 orders and 4 families of Pteridophyta (3.4%), 1 species of gymnosperm and (0.9%) and 111 species of 46 families, 83 genus, 11 variety and 1 forma of angiosperm (95.7%) were confirmed. Among these there were 23 species of 11 families and 23 genus and 3 Varietys for a total of 26 species of Monocotyledoneae (22.4%) and 76 species of 35 families and 72 genus and 8 variety and 1 race for a total of 85 species of Dicotyledoneae (73.3%) (Table 1).

Hydrocharis dubia Bl. Backer, a species which requires permission to be taken outside the country according to Article 41 of the Wild Animals and Plants Protection Law, was confirmed (Fig. 2), and *Euryale ferox* Salisb, class II endangered wildlife species, was also confirmed. Furthermore, *Euryale ferox* was found to be widely prevalent in daepyeong swamp (Fig. 3).

(1) Naturalization Index

A total of 16 taxa consisting of 15 species of 7 families and 15 genus and 1 variety of naturalized plants were confirmed in Daepyeong swamp, and the NI, which shows the degree

of disturbance of natural vegetation, was calculated to be 13.8%.

(2) Urbanization Index

UI is a value which measures the degree of destruction of natural vegetation set by Lim Yang-Jai, Jeon Euy-Sik (1980), and according to the study of Park *et al.* (2002), the UI of Daepyeong swamp was found to be 5.9%.

2) Jilnal swamp

From the study on plants on Jilnal swamp and its surroundings, between April and October of 2007, a total of 115 taxa, consisting of 99 species of 50 family and 99 genus and 1 subspecies, 10 variety, were confirmed. Among these, there were 3 species (2.6%) of 3 orders and 3 families of Pteridophyta, 1 species (0.9%) of 1 order and 1 family of gymnosperms, and a total of 111 types (96.5%), consisting of 95 species of 46 orders and 95 families and 16 Variety species, of angiosperms, and among these, there was a total of 24 types (20.9%), consisting of 20 species and 4 Variety species, of Monocotyledoneae, and a total of 87 taxa (75.7%), consisting of 75 species of 36 orders and 72 families and 12 variety, of Dicotyledoneae (Table 2).

Furthermore, like in the case of Daepyeong swamp, *Hydrocharis dubia* Bl (Fig. 4). Backer, a species which requires permission to be taken outside the country according to the Article 41 of the Wild Animals and Plants Protection Law of Korea, was recorded, and *Euryale ferox*



Fig. 2. *Hydrocharis dubia* (Daepyeong swamp)



Fig. 3. *Euryale ferox* Salisb (Daepyeong swamp)

Table 1. The plants flora in Daepyeong swamp and the surrounded area

Type	Family	Genus	Species	Variety	Forma	Total
Pteridophyta	4	4	4	-	-	4
Gymnosperm	1	1	1	-	-	1
Angiosperm	Monocotyledon	11	23	3	-	26
	Dicotyledoneae	35	76	8	1	85
Total	51	98	104	11	1	116

Table 2. The vascular plants in Jilnal swamp and the surrounded area

Type	Family	Genus	Species	Variety	Forma	Total
Pteridophyta	3	3	3	-	-	3
Gymnosperm	1	1	1	-	-	1
Angiosperm	Monocotyledon	10	20	4	-	24
	Dicotyledoneae	36	72	12	-	87
Total	50	97	99	16	-	115

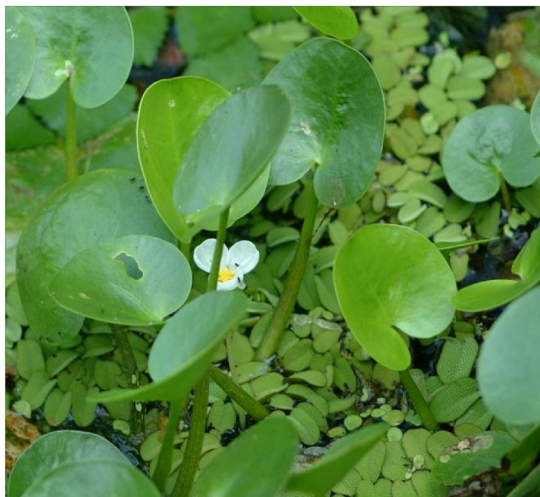


Fig. 4. *Hydrocharis dubia* (Jilnal swamp)

Salisb (Fig. 5), Category II Endangered Wildlife Species, was also recorded.

Furthermore, like in the case of Daepyeong swamp, *Euryale ferox* was found to be widely prevalent in Jilnal swamp as well, but since the area is shallow, *Zizania latifolia* Turcz was distributed in the central part of the swamp. Therefore, getting rid of *Zizania latifolia* Turcz should be considered.

(1) Naturalization Index

A total of 15 taxa consisting of 14 species of 6 families and

14 genus and 1 variety species of naturalized plants were confirmed in Jilnal swamp, and the NI, which shows the degree of disturbance of natural vegetation, was calculated to be 13.0%.

(2) Urbanization Index

UI is a value which measures the destruction degree of natural vegetation set by Lim and Jeon (1980), and according to the study of Park *et al.* (2002), the UI of Jilnal swamp was found to be 5.5%.

In terms of vegetation, there was a total of 116 taxa in Daepyeong swamp and 115 taxa in Jilnal swamp, and the NI was 13.8% for Daepyeong swamp and 13.0% for Jilnal swamp, showing that the NI for Daepyeong swamp was higher. The UI for Daepyeong swamp was 5.9% and 5.5% for Jilnal swamp, with Daepyeong swamp being higher. In both area, the presence of government protected species *Euryale ferox* and *Hydrocharis dubia* were confirmed, which showed that Jilnal swamp requires the same level of legal protection when compared to Daepyeong swamp.

There were a total of 16 taxa, consisting of 15 species of 7 orders and 15 families and a mutant species, confirmed in Daepyeong swamp in terms of naturalized plants, and of these, 9 taxon were from North America. There were a total of 15 taxon, consisting of 14 species of 6 orders and 14 families and a mutant species, confirmed in Jilnal swamp in terms of naturalized plants, and of these, 9 taxon were from

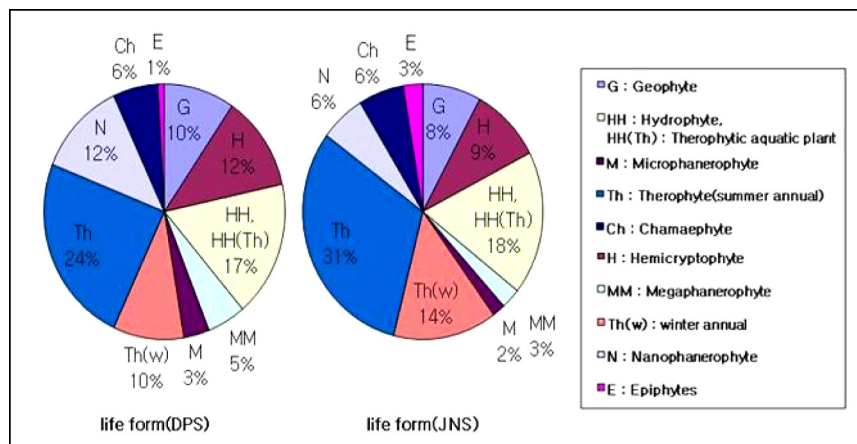


Fig. 5. Study sites and the life form of the surrounding plants

North American origin.

Life form analysis

1) Daepyeong swamp

In terms of Daepyeong swamp, the life form ratio of therophytes was 24% and 17% for hydrophytes and helophytes (Th). The value was 12% for N, 12% for H, 10% for geophytes, 10% for therophytes (winter), 6% for chamaephytes, 3% for MM, 3% for M and 1% for epiphytes.

2) Jilnal swamp

In terms of Jilnal swamp, the life form ratio of Th was 31% and 18% for HH and HH (Th). The value was 6% for N, 9% for H, 8% for G, 14% for Th (w), 6% for Ch, 3% for MM, 3% for E and 2% for M.

For both Daepyeong swamp and Jilnal swamp, the Th value was the highest (Fig. 5-1). Furthermore, the HH and HH (Th) values were recorded to be the next highest at 17% and 18% respectively. In terms of shrubs, Daepyeong swamp showed a higher value at 12%, compared to the 6% of Jilnal swamp, but considering that the species diversity

for the two areas shows no significant difference, (116 for Daepyeong swamp and 115 for Jilnal swamp), the ratio for HH and HH (Th) was higher in the case of Jilnal swamp than Daepyeong swamp. Furthermore, Jilnal swamp showed a higher value at 31%, compared to that of 24% of Daepyeong swamp, in Th as well.

3) Naturalized plants

The flora of Daepyeong swamp and Jilnal swamp were recorded naturalized plants as in the following (Table 3).

Naturalized plants in Daepyeong swamp was recorded 1 variety, 15 species, 15 Genus and 7 families. The place of origin of 9 taxa was North America.

Naturalized plants in Jilnal swamp was recorded 1 variety, 14 species, 14 Genus and 6 families. The place of origin of 9 taxa was North America.

Table 3. List of naturalized plants

Scientific Name	Daepyeong swamp	Jilnal swamp	Native habitat
Polygonaceae			
<i>Rumex crispus</i> L.			E
Chenopodiaceae			
<i>Chenopodium ficifolium</i> Smith			E
Phytolaccaceae			
<i>Phytolacca americana</i> L.			NA
Cruciferae			
<i>Lepidium apetalum</i> Willd.			NA
Leguminosae			
<i>Robinia pseudo-acacia</i> L.			NA
<i>Amorpha fruticosa</i> L.			NA
<i>Astragalus sinicus</i> L.			A
<i>Trifolium repens</i> L.			E
Onagraceae			
<i>Oenothera odorata</i> Jacq.			SA
Compositae			
<i>Ambrosia artemisiifolia</i> var. <i>elatior</i> Descourtils			NA
<i>Xanthium strumarium</i> L.			NA
<i>Erigeron annuus</i> (L.) Pers.			NA
<i>Erigeron canadensis</i> L.			NA
<i>Bidens frondosa</i> L.			NA
<i>Cosmos bipinnatus</i> Cav.			M
<i>Sonchus asper</i> (L.) Hill			A
Total	16	15	

*A: Asia, E: Europe, M: Mexico, NA: North America, SA: South America

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Appendix 1. List of vascular plants distributed in Daepyeong swamp and Jinal swamp

Scientific Name (Common name)	Daepyeong swamp				Jinal swamp			Life form
	A	B	C	D	E	F	G	
Equisetaceae 속새과								
<i>Equisetum arvense</i> L. 쇠뜨기								G
Pteridaceae 고사리과								
<i>Dennstaedtia wilfordii</i> (MOORE) CHRIST. 황고사리								H
Aspidiaceae 면마과								
<i>Athyrium yokoscense</i> (FR. et SAV.) H. CHRIST. 뺨고사리								H
<i>Dryopteris chinensis</i> (Baker) Koidz. 가는잎죽제비고사리								H
Aspleniaceae 꼬리고사리과								
<i>Asplenium incisum</i> THUNB. 꼬리고사리								H
Marsiliaceae 네가래과								
<i>Marsilea quadrifolia</i> L. 네가래								HH(Th)
Salviniaceae 생이가래과								
<i>Salvinia natans</i> (L.) All 생이가래								HH(Th)
Pinaceae 소나무과								
<i>Larix kaempferi</i> (Lamb.) Carriere 일본잎갈나무								MM
<i>Pinus densiflora</i> S. et Z. 소나무								MM
<i>Pinus thunbergii</i> P. ARL. 곰솔								MM
Typhaceae 부들과								
<i>Typha angustifolia</i> L. 애기부들								HH
Potamogetonaceae 가래과								
<i>Potamogeton crispus</i> L. 말즘								HH
<i>Potamogeton cristatus</i> REGEL et MAACK 가는가래								HH
<i>Potamogeton distinctus</i> A. B. ENN. 가래								HH
<i>Potamogeton maackianus</i> A. B. ENN. 새우가래								HH
<i>Potamogeton octandrus</i> Poir. var. <i>octandrus</i> 애기가래								HH
Najadaceae 나자스말과								
<i>Najas graminea</i> Del. 나자스말								HH(Th)
<i>Najas marina</i> L. 민나자시말								HH(Th)
Alismataceae 렉사과								
<i>Sagittaria aginashi</i> Makino 보풀								HH
<i>Sagittaria sagittifolia</i> subsp. <i>leucopetala</i> (Mig.) Hartog. 벚풀								HH
Hydrocharitaceae 자라풀과								
<i>Hydrilla verticillata</i> (L.f.) Royle 검정말								HH(Th)
<i>Hydrocharis dubia</i> (B.L.) BACKER 자라풀								HH(Th)
Gramineae 벼과								
<i>Agropyron tsukushiense</i> var. <i>transiens</i> (HACK.) OHWI 개밀								Th(w)
<i>Alopecurus aequalis</i> Sobol. 뚝새풀								Th(w)
<i>Beckmannia syzigachne</i> (STEUD.) FERN. 개피								HH(Th)
<i>Bromus japonicus</i> Thunb. ex Murray 참새귀리								Th
<i>Dactylis glomerata</i> L. 오리새								H
<i>Echinochloa crus-galli</i> var. <i>caudata</i> Kitag 물피								HH(Th)
<i>Echinochloa crus-galli</i> (L.) P. Beauv. var. <i>crus-galli</i> . 돌피								Th
<i>Eleusine indica</i> (L.) Gaertn. 왕마랭이								Th
<i>Eragrostis ferruginea</i> (THUNB.) Beauv. 그렁								H
<i>Eragrostis japonica</i> (THUNB.) Trinius 각시그렁								H
<i>Eriochloa villosa</i> (THUNB.) Kunth 나도개피								Th
<i>Festuca arundinacea</i> SCHREB. 큰김의털								H
<i>Hemarthria sibirica</i> (GANDOG) OHWI 쇠치기풀								H
<i>Imperata cylindrica</i> var. <i>koenigii</i> (Retz.) Pilg. 락								Th
<i>Leersia japonica</i> Makino 나도겨풀								Th
<i>Miscanthus sinensis</i> Andersson var. <i>sinensis</i> 참억새								H
<i>Miscanthus sacchariflorus</i> (Maxim.) Benth. 물억새								H
<i>Oplismenus undulatifolius</i> (Ard.) P. Beauv. var. <i>undulatifolius</i> 주름조개풀								H
<i>Panicum bisulcatum</i> Thunb. 개기장								Th
<i>Paspalum thunbergii</i> Kunth ex Steud. 참새피								Th
<i>Pennisetum alopecuroides</i> (L.) Spreng. var. <i>alopecuroides</i> 수크렁								Th
<i>Phalaris arundinacea</i> L. 갈풀								HH

Appendix 1. Continued

Scientific Name (Common name)	Daepyeong swamp				Jilnal swamp			Life form
	A	B	C	D	E	F	G	
<i>Phragmites communis</i> TRIN. 갈대								HH
<i>Setaria faberii</i> Herrmann 가을강아지풀								Th
<i>Setaria viridis</i> (L.) P.Beauv. var. <i>viridis</i> 강아지풀								Th
<i>Trisetum bifidum</i> (T.HUNB.) OHWI 잠자리피								Th
<i>Zizania latifolia</i> (Griseb.) Turcz. ex Stapf 줄								HH
Cyperaceae 사초과								
<i>Carex dimorpholepis</i> STEUD. 이삭사초								H
<i>Carex neurocarpa</i> MAX. 팽이사초								H
<i>Carex siderosticta</i> Hance 대사초								H
<i>Cyperus iria</i> L. 참방동사니								HH
<i>Cyperus difformis</i> L. 알방동사니								HH(Th)
<i>Cyperus serotinus</i> ROTTB. 너도방도사니								Th
<i>Cyperus microiria</i> Steud. 금방동사니								Th
<i>Eleocharis attenuata</i> for. <i>laeviseta</i> (Nakai) Hara 참바늘골								HH
<i>Fimbristylis autumnalis</i> (L.) ROEM. et SCHULT. 애기하늘지기								HH
<i>Fimbristylis miliacea</i> (L.) Vahl 바람하늘지기								HH(Th)
<i>Kyllinga brevifolia</i> Rottb. 파대가리								HH
<i>Scirpus triangulatus</i> Roxb. 송이고랭이								HH
<i>Scirpus nipponicus</i> MAKINO 물고랭이								HH
<i>Scirpus lacustris</i> var. <i>creber</i> (Fern.) T.Koyama 큰고랭이								HH
<i>Scirpus triqueter</i> Linne 세모고랭이								HH
<i>Scirpus wichuriae</i> var. <i>asiaticus</i> (Beetle) T.Koyama 방울고랭이								HH
Araceae 천남성과								
<i>Acorus calamus</i> L. 창포								HH
Lemna 개구리밥과								
<i>Lemna perpusilla</i> Torr. 좁개구리밥								HH(Th)
<i>Spirodela polyrhiza</i> (L.) SCHLEID. 개구리밥								HH(Th)
Commelinaceae 닭의장풀과								
<i>Aneilema keisak</i> HASSK. 사마귀풀								Th
<i>Commelina communis</i> L. 닭의장풀								Th
Pontederiaceae 물옥잠과								
<i>Monochoria korsakowii</i> Regel et Maack 물옥잠								HH
<i>Monochoria vaginalis</i> var. <i>plantaginea</i> (Roxb.) Solms 물달개비								HH
Liliaceae 백합과								
<i>Allium thunbergii</i> G.DON 산부추								G
<i>Liriope platyphylla</i> F.T.Wang & T.Tang 맥문동								G
<i>Liriope spicata</i> (Thunb.) Lour. 개맥문동								G
<i>Scilla scilloides</i> (LIND.) DRUCE 무릇								G
<i>Smilax china</i> L. 청미래덩굴								N
<i>Smilax nipponica</i> MIQ. 선밀나물								G
<i>Smilax sieboldii</i> Miq. for. <i>sieboldii</i> 청가시덩굴								N
Dioscoreaceae 마과								
<i>Dioscorea batatas</i> Decne. 마								G
<i>Dioscorea japonica</i> THUNB. 참마								G
<i>Dioscorea tenuipes</i> FR. et SAV. 각시마								G
Orchidaceae 난초과								
<i>Liparis krameri</i> FR. et SAV. 나나별이난초								G
Saliaceae 버드나무과								
<i>Populus nigra</i> var. <i>italica</i> Koehne 양버들								MM
<i>Salix chaenomeloides</i> Kimura. 왕버들								MM
<i>Salix gilgiana</i> SEEM. 내버들								N
<i>Salix gracilistyla</i> MIQ. 갯버들								N
<i>Salix koreensis</i> Andersson 버드나무								MM
Juglandaceae 가래나무과								
<i>Platycarya strobilacea</i> S. & Z. var. <i>strobilacea</i> for. <i>strobilacea</i> 굴피나무								MM
Betulaceae 자작나무과								
<i>Alnus sibirica</i> Fisch. ex Turcz. 물오리나무								MM

Appendix 1. Continued

Scientific Name (Common name)	Daepyeong swamp				Jilnal swamp			Life form
	A	B	C	D	E	F	G	
Fagaceae 참나무과								
<i>Castanea crenata</i> S. et Z. 밤나무								MM
<i>Quercus aliena</i> B.L. 갈참나무								MM
<i>Quercus dentata</i> T _{HUNB.} 떡갈나무								MM
<i>Quercus serrata</i> Thunb. ex Murray 졸참나무								MM
<i>Quercus variabilis</i> B.L. 굴참나무								MM
Ulmaceae 느릅나무과								
<i>Celtis sinensis</i> P _{ERS.} 팽나무								MM
Moraceae 뽕나무과								
<i>Morus bombycis</i> Koidz. var. <i>bombycis</i> 산뽕나무								M
<i>Fatoua villosa</i> (Thunb.) Nakai 뽕모시풀								Th
Cannabaceae 삼과								
<i>Humulus japonicus</i> Siebold & Zucc. 환삼덩굴								Th
Urticaceae 켜기풀과								
<i>Boehmeria spicata</i> (Thunb.) Thunb. 쯤깨잎나무								Th
<i>Boehmeria platanifolia</i> F _{R.} et S _{AV.} 개모시풀								Th
<i>Boehmeria tricuspis</i> (Hance) Makino 거북꼬리								Ch
Polygonaceae 마디풀과								
<i>Persicaria brevichreata</i> (Makino) Ohwi 긴화살여뀌								Th
<i>Persicaria conspicua</i> (Nakai) Nakai ex Mori 꽃여뀌								H
<i>Persicaria filiformis</i> (Thunb.) Nakai ex Mori 이삭여뀌								Th
<i>Persicaria hastatosagittata</i> (Makino) Nakai ex Mori 긴미꾸리늪시								HH
<i>Persicaria hydropiper</i> (L.) Spach var. <i>hydropiper</i> 여뀌								HH(Th)
<i>Persicaria japonica</i> (Meisn.) H.Gross ex Nakai 흰꽃여뀌								HH
<i>Persicaria lapathifolia</i> (L.) Gray var. <i>lapathifolia</i> 흰여뀌								Th
<i>Persicaria longiseta</i> (Brujin) Kitag. 개여뀌								Th
<i>Persicaria maackiana</i> (Regel) Nakai ex Mori 나도미꾸리늪시								HH
<i>Persicaria perfoliata</i> (L.) H.Gross 머느리베짚								Th
<i>Persicaria senticosa</i> (Meisn.) H.Gross ex Nakai var. <i>senticosa</i> 머느리밀셋개								Th
<i>Persicaria thunbergii</i> (S. et Z.) H.Gross ex Nakai 고마리								HH(Th)
<i>Persicaria viscosa</i> (Hamilt. ex D.Don) H.Gross ex Nakai 기생여뀌								HH(Th)
<i>Polygonum aviculare</i> L. 마디풀								Th
<i>Rumex crispus</i> L. 소리쟁이								H
<i>Rumex conglomeratus</i> M _{URR.} 목발소리쟁이								H
<i>Rumex obtusifolius</i> L. 돌소루쟁이								H
Aizoaceae 석류풀과								
<i>Mollugo pentaphylla</i> L. 석류풀								Th
Chenopodiaceae 명아주과								
<i>Chenopodium album</i> L. var. <i>album</i> 흰명아주								Th
<i>Chenopodium ficifolium</i> S _{MITH.} 줄명아주								Th
<i>Chenopodium glaucum</i> L. 취명아주								Th
Amaranthaceae 비름과								
<i>Achyranthes japonica</i> (M _{IQ.}) N _{AKAI.} 쇠무릎								Th
<i>Amaranthus mangostanus</i> L. 비름								Th
Phytolaccaceae 자리공과								
<i>Phytolacca americana</i> L. 미국자리공								G
Portulacaceae 쇠비름과								
<i>Portulaca oleracea</i> L. 쇠비름								Th
Caryophyllaceae 석죽과								
<i>Sagina japonica</i> (Sw.) Ohwi 개미자리								Th
<i>Arenaria serpyllifolia</i> L. 벼룩이자리								Th(w)
<i>Cerastium holosteoides</i> var. <i>hallaisanense</i> (Nakai) Mizush. 점나도나물								H
<i>Stellaria aquatica</i> (L.) Scop. 쇠별꽃								Th(w)
<i>Stellaria media</i> (L.) Vill. 별꽃								Th(w)
<i>Stellaria alsine</i> var. <i>undulata</i> (Thunb.) Ohwi 벼룩나물								Th(w)
<i>Dianthus chinensis</i> L. var. <i>chinensis</i> 패랭이꽃								Th
<i>Dianthus longicalyx</i> Miq. 술패랭이꽃								Th

Appendix 1. Continued

Scientific Name (Common name)	Daepyeong swamp				Jilnal swamp			Life form
	A	B	C	D	E	F	G	
<i>Gysophila oldhamiana</i> M _{IQ} . 대나무								Th
<i>Melandryum seoulense</i> N _{AKAI} 가는장구채								H
Ceratophyllaceae 붕어마름과								
<i>Ceratophyllum demersum</i> L. var. <i>demersum</i> 붕어마름								HH(Th)
<i>Ceratophyllum demersum</i> var. <i>quadrispinum</i> Makino 다섯가시붕어말								HH(Th)
Ranunculaceae 미나리아재비과								
<i>Clematis apiifolia</i> DC. 사위질빵								N
<i>Clematis terniflora</i> var. <i>mandshurica</i> (Rupr.) Ohwi 으아리								N
<i>Clematis terniflora</i> DC. 참으아리								N
<i>Clematis trichotoma</i> Nakai 할미밀망								N
<i>Ranunculus japonicus</i> Thunb. 미나리아재비								HH
<i>Ranunculus tachiroei</i> Franch. & Sav. 개구리미나리								HH
<i>Thalictrum aquilegifolium</i> var. <i>sibiricum</i> Regel & Tiling 평의다리								G
Menispermaceae 방기과								
<i>Cocculus trilobus</i> (Thunb.) DC. 땡앵이덩굴								N
<i>Menispermum dauricum</i> DC. 새모래덩굴								N
Nymphaeaceae 수련과								
<i>Euryale ferox</i> Salisb. 가시연꽃								HH(Th)
Hypericaceae 풀레나물과								
<i>Hypericum erectum</i> Thunb. 고추나물								H
Papaveraceae 양귀비과								
<i>Chelidonium majus</i> var. <i>asiaticum</i> (H _{ARA}) O _{HWI} 애기똥풀								Th(w)
Cruciferae 십자화과								
<i>Brassica juncea</i> (L.) Czern. var. <i>juncea</i> 갓								Th(w)
<i>Capsella bursapastoris</i> (L.) L.W.Medicus 냉이								Th(w)
<i>Cardamine flexuosa</i> W _{ITH} . 황새냉이								Th(w)
<i>Draba nemorosa</i> L. for. <i>nemorosa</i> 꽃다지								Th(w)
<i>Leersia japonica</i> Makino. 나도겨풀								Th(w)
<i>Lepidium apetalum</i> Willd. 다닥냉이								Th(w)
<i>Rorippa cantoniensis</i> (Lour.) Ohwi 좁개갓냉이								Th(w)
<i>Rorippa indica</i> (L.) Hiern 개갓냉이								Th(w)
<i>Rorippa palustris</i> (Leyss.) Besser 속속이풀								Th(w)
<i>Thlaspi arvense</i> L. 말냉이								Th(w)
Crassaceae 돌나물과								
<i>Sedum kamtschaticum</i> Fisch. & Mey. 기린초								H
<i>Sedum sarmentosum</i> Bunge 돌나물								H
<i>Sedum polytrichoides</i> Hemsl. 바위채송화								H
<i>Sedum bulbiferum</i> Makino 말뚝비름								H
Eucommiaceae 두충과								
<i>Eucommia ulmoides</i> O _{LIVER} 두충								M
Rosaceae 장미과								
<i>Duchesnea indica</i> (Andr.) Focke. 뱀딸기								Ch
<i>Potentilla anemonefolia</i> Lehm. 가락지나물								Ch
<i>Potentilla fragarioides</i> var. <i>major</i> Maxim. 양지꽃								Ch
<i>Potentilla freyniana</i> Bornm. 세잎양지꽃								Ch
<i>Rosa multiflora</i> Thunb. var. <i>multiflora</i> 짙레나무								N
<i>Rosa wichuraiana</i> Crep. ex Franch. & Sav. 돌가시								N
<i>Rubus crataegifolius</i> B _{UNGE} 산딸기								N
<i>Rubus idaeus</i> var. <i>microphyllus</i> Turcz. 멍석딸기								N
<i>Sanguisorba officinalis</i> L.. 오이풀								G
<i>Spiraea prunifolia</i> for. <i>Simpliciflora</i> N _{AKAI} 조팝나무								N
<i>Stephanandra incisa</i> (Thunb.) Zabel var. <i>incisa</i> 국수나무								N
Leguminosae 콩과								
<i>Aeschynomene indica</i> L. 자귀풀								Th
<i>Albizzia julibrissin</i> D _{URAZZ} . 자귀나무								M
<i>Amorpha fruticosa</i> L. 죽제비싸리								N
<i>Amphicarpea bracteata</i> subsp. <i>edgeworthii</i> (Benth.) H.Ohashi 새콩								Th

Appendix 1. Continued

Scientific Name (Common name)	Daepyeong swamp				Jilnal swamp			Life form
	A	B	C	D	E	F	G	
<i>Astragalus sinicus</i> L. 자운영								Ch
<i>Chamaecrista nomame</i> (Siebold) H. Ohashi 차풀								Th
<i>Desmodium podocarpum</i> var. <i>oxyphyllum</i> (DC.) H. Ohashi 도독놈의갈고리								H
<i>Glycine soja</i> Sieb. et Zucc. 돌콩								Th
<i>Indigofera kirilowii</i> Maxim. ex Palib. 땅비싸리								N
<i>Indigofera pseudotinctoria</i> Matsum. 냥아초								N
<i>Kummerowia striata</i> (Thunb.) S. Chindl. 매듭풀								Th
<i>Lеспедеза bicolor</i> Turcz. 싸리								N
<i>Lеспедеза cuneata</i> G. Don 비수리								H
<i>Lеспедеза cyrtobotrya</i> Miq. 참싸리								N
<i>Lеспедеза tomentosa</i> (Thunb.) Siebold ex Maxim. 개싸리								N
<i>Lеспедеза thunbergii</i> subsp. <i>formosa</i> (Vogel) H. Ohashi 풀싸리								N
<i>Pisum sativum</i> L. 완두								Th
<i>Pueraria thunbergiana</i> Benth. 칩								Ch
<i>Robinia pseudoacacia</i> L. 아까시나무								MM
<i>Trifolium repens</i> L. 토끼풀								Ch
<i>Vicia tetrasperma</i> (L.) Schreb. 얼치기완두								Th
<i>Vigna unguiculata</i> (L.) Walp. 동부								Th
Oxalidaceae 썩이밥과								
<i>Oxalis corniculata</i> L. 썩이밥								Ch
Rutaceae 윤향과								
<i>Zanthoxylum schinifolium</i> S. et Z. 산초나무								M
Euphobiaceae 대극과								
<i>Acalypha australis</i> L. 깨풀								Th
<i>Securinega suffruticosa</i> (Pall.) Rehder 광대싸리								M
Callitrichaceae 별이끼과								
<i>Callitriche palustris</i> L. 물별이끼								HH(Th)
Anacardiaceae 옷나무과								
<i>Rhus javanica</i> L. 붉나무								M
Celastraceae 노박덩굴과								
<i>Euonymus trapococca</i> Nakai 버들회나무								N
<i>Celastrus orbiculatus</i> Thunb. 노박덩굴								E
<i>Euonymus alatus</i> for. <i>ciliatodentatus</i> (Franch. & Sav.) Hiyama 회잎나무								N
Vitaceae 포도과								
<i>Ampelopsis brevipedunculata</i> (Maxim.) Trautv. 개머루								E
<i>Vitis flexuosa</i> Thunb. 새머루								E
Sterculiaceae 벽오동과								
<i>Corchoropsis psilocarpa</i> Harms & Loes. 가지깨								Th
Violaceae 제비꽃과								
<i>Viola mandshurica</i> W. Becker 제비꽃								H
<i>Viola patrinii</i> DC. ex Ging. 흰제비꽃								H
<i>Viola yedoensis</i> Makino 호제비꽃								H
Lythraceae 부처꽃과								
<i>Ammannia multiflora</i> Roxb. 쯤부처꽃								HH
<i>Rotala indica</i> (Willd.) Koehne 마디꽃								HH
Hydrocaryaceae 마름과								
<i>Trapa japonica</i> Flerow 마름								HH
Onagraceae 바늘꽃과								
<i>Ludwigia prostrata</i> Roxb. 여뀌바늘								HH(Th)
<i>Oenothera biennis</i> L. 달맞이꽃								Th(w)
Halorrhagaceae 개미뿔과								
<i>Myriophyllum spicatum</i> L. 이삭물수세미								HH
<i>Myriophyllum verticillatum</i> L. 물수세미								HH
Umbelliferae 산형과								
<i>Hydrocotyle maritima</i> Honda 선피막이								Th
<i>Oenanthe javanica</i> (Blume) DC. 미나리								HH
<i>Pterygopleurum neurophyllum</i> (Maxim.) Kitag. 서울개발나무								HH

Appendix 1. Continued

Scientific Name (Common name)	Daepyeong swamp				Jilnal swamp			Life form
	A	B	C	D	E	F	G	
<i>Torilis japonica</i> (Houtt.) DC. 사상자								Th(w)
<i>Torilis scabra</i> (Thunb.) DC. 개사상자								Th
Ericaceae 진달래과								
<i>Rhododendron mucronulatum</i> var. <i>ciliatum</i> Nakai 털진달래								N
Pyrolaceae 노루발과								
<i>Pyrola japonica</i> Klenze ex Alef. 노루발								Ch
Primulaceae 앵초과								
<i>Lysimachia clethroides</i> Duby 큰까치수염								G
Ebenaceae 감나무과								
<i>Diospyros lotus</i> L. 고욤나무								MM
Oleaceae 물푸레나무과								
<i>Ligustrum obtusifolium</i> S. et Z. 쥐똥나무								N
Menyanthaceae 조름나물과								
<i>Nymphoides peltata</i> (J.G.Gmelin) Kuntze 노랑어리연꽃								HH
Asclepiadaceae 박주가리과								
<i>Metaplexis japonica</i> (Thunb.) Makino 박주가리								G
Convolvulaceae 메꽃과								
<i>Calystegia hederacea</i> Wall. 애기메꽃								G
<i>Calystegia sepium</i> var. <i>japonicum</i> (Choisy) Makino 메꽃								G
<i>Calystegia sepium</i> (L.) R.Br. 큰메꽃								G
<i>Cuscuta australis</i> R.Br. 실새삼								Th
<i>Quamoclit coccinea</i> Moench 등근일유홍초								Th
Borraginaceae 지치과								
<i>Trigonotis peduncularis</i> (Trevir.) Benth. ex Hemsl. 꽃마리								Th(w)
Labiatae 꿀풀과								
<i>Isodon inflexus</i> (THUNB.) Kudo 산박하								G
<i>Lamium amplexicaule</i> L. 광대나물								Th(w)
<i>Leonurus japonicus</i> Houtt. 익모초								Th(w)
<i>Mosla punctulata</i> (J.E. Gmel.) Nakai 들깨풀								Th
<i>Salia plebeia</i> R. Br. 배암차즈기								Th(w)
<i>Scutellaria indica</i> L. 골무꽃								Th(w)
<i>Stachys japonica</i> Miq. 석잠풀								H
Solanaceae 가지과								
<i>Lycium chinense</i> MILL. 구기자나무								N
Scrophulariaceae 현삼과								
<i>Mazus pumilus</i> (Burm.f.) Steenis 주름잎								Th
<i>Phtheirospermum japonicum</i> (Thunb.) Kanitz 나도송이풀								H
<i>Veronica persica</i> POIR. 큰개불알풀								Th
<i>Veronica dichroma</i> var. <i>lilacina</i> (H.Hara) T.Yamaz. 개불알풀								Th
Pedalidaceae 참깨과								
<i>Trapella sinensis</i> var. <i>antenifera</i> (H.Lev.) H.Hara 수염마름								HH
<i>Trapella sinensis</i> var. <i>sinensis</i> 세수염마름								HH
Lentibulariaceae 통발과								
<i>Utricularia vulgaris</i> var. <i>japonica</i> (Makino) Tamura 통발								HH
Acanthaceae 쥐꼬리망초과								
<i>Justicia procumbens</i> L. 쥐꼬리망초								Th
Plantaginaceae 질경이과								
<i>Plantago asiatica</i> L. 질경이								H
Rubiaceae 꼭두서니과								
<i>Galium dahuricum</i> Turcz. var. <i>dahuricum</i> 큰잎갈퀴								Th
<i>Galium pogonanthum</i> Franch. & Sav. 산갈퀴								Th
<i>Galium spurium</i> var. <i>echinospermon</i> (Wallr.) Hayek 갈퀴덩굴								Th
<i>Galium trachyspermum</i> A. GRAY 네잎갈퀴								Th
<i>Rubia akane</i> Nakai 꼭두서니								Th
Caprifoliaceae 인동과								
<i>Lonicera japonica</i> THUNB. 인동덩굴								E
Valerianaceae 마타리과								

Appendix 1. Continued

Scientific Name (Common name)	Daepyeong swamp				Jilnal swamp			Life form
	A	B	C	D	E	F	G	
<i>Patrinia villosa</i> (Thunb.) Juss. 뚝갈								H
Cucurbitaceae 박과								
<i>Actinostemma lobatum</i> Maxim. 뚜껍덩굴								Th
Campanulaceae 초롱꽃과								
<i>Adenophora verticillata</i> var. <i>hirsuta</i> F.Schmidt 털잔대								G
<i>Adenophora triphylla</i> var. <i>japonica</i> (Regel) H.Hara 잔대								G
<i>Lobelia chinensis</i> L _{OUR} . 수염가래꽃								HH
Compositae 국화과								
<i>Ambrosia artemisiifolia</i> L. 돼지풀								Th
<i>Artemisia apiacea</i> Hance ex Walp. 개사철쭉								H
<i>Artemisia keiskeana</i> Miq. 맑은대쭉								H
<i>Artemisia princeps</i> Pamp. 쭉								Ch
<i>Artemisia rubripes</i> NAKAI 덩불쭉								Th
<i>Artemisia selengensis</i> Turcz. ex Besser 물쭉								Th(w)
<i>Artemisia selengensis</i> for. <i>subintegra</i> (Pamp.) Kitag. 외잎물쭉								Th(w)
<i>Aster incisus</i> Fisch. 가새쭉부쟁이								Ch
<i>Aster yomena</i> (Kitam.) Honda 쭉부쟁이								Th
<i>Aster scaber</i> THUNB. 참취								G
<i>Bidens bipinnata</i> L. 도깨비바늘								Th
<i>Bidens frondosa</i> L. 미국가막사리								Th
<i>Bidens tripartita</i> L. 가막사리								Th
<i>Cirsium japonicum</i> var. <i>maackii</i> (Maxim.) Matsum. 영경귀								H
<i>Cosmos bipinnatus</i> Cav. 코스모스								Th
<i>Conyza canadensis</i> (L.) Cronquist 망초								Th(w)
<i>Crassocephalum crepidioides</i> (B _{ENTH.}) S. MOORE 주홍서나물								Th
<i>Pediastrum sonchifolium</i> (Bunge) Pak & Kawano 고들빼기								Th(w)
<i>Dendranthema boreale</i> (Makino) Ling ex Kitam. 산국								H
<i>Eclipta prostrata</i> (L.) L. 환련초								Th
<i>Erigeron annuus</i> (L.) PERS. 개망초								Th(w)
<i>Erechtites hieracifolia</i> Raf 붉은서나물								Th
<i>Eupatorium makinoi</i> var. <i>oppisitifolium</i> (Koidz.) Kawahara & Yahara 별등골나물								G
<i>Galinsoga parviflora</i> Cav. 별꽃아재비								Th
<i>Gnaphalium affine</i> D.Don 떡쭉								Th
<i>Hemistrpta lyrata</i> BUNGE 지청개								Th(w)
<i>Helianthus tuberosus</i> L. 뚱딴지								G
<i>Ixeridium dentatum</i> (Thunb. ex Mori) Tzvelev 썸바귀								Th
<i>Ixeris polycephala</i> Cass. 별썸바귀								Th
<i>Lactuca indica</i> L. 왕고들빼기								Th(w)
<i>Lactuca raddeana</i> Maxim. 산썸바귀								Th
<i>Lactuca scariola</i> L. 가시상추								Th
<i>Sigesbeckia glabrescens</i> (Makino) Makino 진득찰								Th
<i>Sonchus asper</i> (L.) Hill 큰방가지뚱								Th
<i>Taraxacum coreanum</i> NAKAI 흰민들레								H
<i>Youngia japonica</i> (L.) DC. 뽕리뱅이								Th(w)
<i>Xanthium strumarium</i> L. 도꼬마리								Th
<i>Verbesina alternifolia</i> Britton 나래가막사리								Th

*Location: A-Joung etc (1987), B-Ministry of Environment of Korea (2001), C-Haman-gun (2006), D-Observed (2007), E-Joung etc (1987), F-Ministry of Environment of Korea (2001), G-Observed (2007)

*Th: Therophyte (summer annual), Th (w): winter annual, G: Geophyte, H: Hemicryptophyte, Ch: Chamaephyte, N: Nanophanerophyte, M: Microphanerophyte, MM: Megaphanerophyte, HH: Hydrophyte, HH (Th): Therophytic aquatic plant, E: Epiphytes