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## Flora and Vegetation of Ukijima Mire

### Conservational Flora of Hokkaido 2

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#### Abstract

In the present paper, the authors listed (1) Lichens, Musci, Pteridophyta and Spermatophyta collected, and (2) plant communities registered in Ukijima Mire centered at 43°56'N and 142°58' E, approximately 870 m in alt., C. Hokkaido.

Furthermore the authors discussed on the standards of conservation values of species protected for nature conservation. Using the simplest standard for this, the following items were considered to be "Important species": **A.** Noticeable species in Taxonomy and Phytogeography, *Cornus suecica* Linn., *Lycopodium inundatum* Linn., *Vaccinium microcarpum* Linn., *Eriocaulon sachalinense* Miyabe et Nakai; **B.** Valuable species for conservation, *Sphagnum* species; and **C.** Endangered or threatened species, *Sphagnum* species and Bonsai forms of *Picea glehnii*.

Aside from the standards mentioned above, the authors designed "Degree of muddiness" or "Nukarumi-Do" in Japanese to estimate tolerance of plants to treading. From the results, the authors considered that it is imperative to protect the Caricetum limosae, the Scheuchzerio-Rhynchosporium albae boreale and the Sphagnetum from the treading.

**Key Words:** Conservational flora, Degree of muddiness, Endangered species, Noticeable species in Taxonomy and Phytogeography, Standards of conservational value of species, Threatened species, Ukijima mire, Valuable species for conservation.

### 1. Introduction

Ukijima mire is a part of the Takinoue Plateau situated 7 km of the southwest of Mt. Teshio (1,557.6 m in alt.), and 4.5 km of the northnorthwest of Kamikoshi National Railway Station, centered at 43°56'N and 142°58' E (Figure 1). The mire has developed on a gently sloping volcanic terrace from 865.5 m to 870 m in alt. The physiognomy of the mire is characterized by 70 deep or shallow pools or ponds, some of which have "Ukijima" or "floating islets". This mire area was designated as a landscape preservation and protection forest by Kamikawa Forestry Office in 1960. Since then, visitors are increasing year by year, and the tourism is affecting the original vegetation which is sensitive to man's impacts, and is leading to the deterioration. From the point of view of nature conservation as well as of phytosociological interest, we conducted our scientific works in 1967 and 1968 (Ito

and Umezawa 1970), and in 1985. As a result, we have concluded that this mire is one of the invaluable mires in Japan, which must be protected from unreasonable man's activities, and managed wisely for the long-term maintenance and preservation because both flora and vegetation are of considerable interest and noticeable as an excellent example of tephra-oligotrophic mire of Japan (*cf.* Wolejko and Ito 1986).

## 2. Enumeration of plants collected in Ukijima mire

### LICHENS

#### Ascolichens (Ascomycetes)

##### *Cladoniaceae*

*Cladonia rangifera* (L.) Web. Hanagoke

### MUSCI

#### *Sphagnidae* *cf.* Suzuki, H. (1972)

##### *Sphagnaceae*

*Sphagnum flexuosa* Dozy et Molk (= *Sph. amblyphyllum* (Russ.) Zickendr. Aomorimizugoke  
*Sph. apiculatum* Lindb. Sankakumizugoke  
*Sph. dusenii* Warnst. Futoharimizugoke  
*Sph. fuscum* (Schimp.) Klinggr. Chamizugoke  
*Sph. magellanicum* Brid. Murasakimizugoke  
*Sph. papillosum* Lindb. Ibomizugoke  
*Sph. pulchrum* (Braithw.) Warnst. Utsukushimizugoke  
*Sph. rubellum* Wils. Akamizugoke  
*Sph. tenellum* Hoffm. Watamizugoke

### *Bryidae*

##### *Polytrichaceae*

*Polytrichum* spp. Sugigoke

##### *Grimmiaceae*

*Rhacomitrium lanuginosum* (Hedw.) Brid. Shimofurigoke

##### *Aulacomniaceae*

*Aulacomnium palustre* (Hedw.) Schwaeger. Ôimogoke

##### *Amblystegiaceae*

*Calliergon stramineum* (Brid.) Lindb. Itosasabagoke

*Pleurozium schreberi* (Brid.) Mitt. Tachihagoke

### *Hepaticae*

##### *Lochoziaceae*

*Gymnocolea inflata* (Huds.) Dum. Heritoriurokogoke

##### *Cephaloziaceae*

*Cephalozia otaruensis* Steph. Otaruyabanegoke

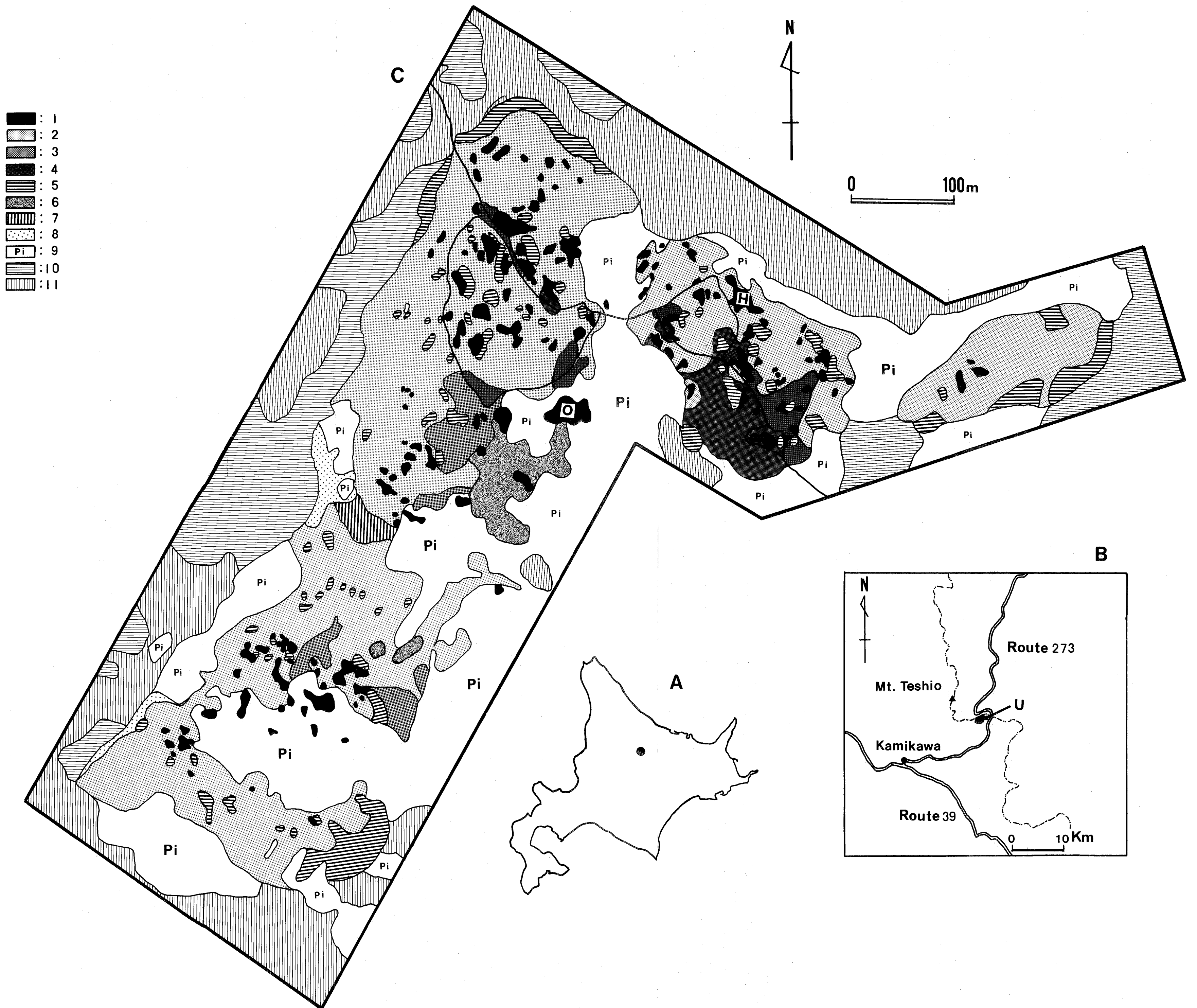


Figure 1. Geological location of Ukijima mire (A & B), and a map of community complexes (C).

*Cladopediella fluitans* (Nees) Buch

Ukiyabanegoke

PTERIDOPHYTA

*Lycopodiaceae*

*Lycopodium clavatum* Linn. var. *nipponicum* Nakai

Hikagenokazura

*L. complanatum* Linn.

Asuhikazura

*L. inundatum* Linn.

Yachisugiran

*L. obscurum* Linn.

Mannensugi

*Osmundaceae*

*Osmunda asiatica* (Fernald) Ohwi

Yamadorizenmai

*Aspidiaceae*

*Lastrea phlegopteris* (Linn.) Bory

Miyamawarabi

*L. queipaertensis* (H. Chr.) Copel.

Ôbashorima

SPERMATOPHYTA

GYMNOSPERMAE

*Pinaceae*

*Abies sachalinensis* (Fr. Schm.) Masters

Todomatsu

*Picea glehnii* (Fr. Schm.) Masters

Akaezomatsu

*Pinus pumila* (Pallas) Regel

Haimatsu

ANGIOSPERMAE

Dicotyledoneae

*Choripetalae*

*Myricaceae*

*Myrica gale* Linn. var. *tomentosa* C. DC.

Yachiyanagi

*Betulaceae*

*Alnus hirsuta* Turcz.

Keyamahannoki

*Betula ermanii* Cham.

Dakekanba

*Nymphaeaceae*

*Nymphaea tetragona* Georgi var. *erythrostigmatica* Ko. Ito

Ezobenihitsujigusa

*N. tetragona* Georgi var. *tetragona*

Ezohitsujigusa

*Ranunculaceae*

*Anemone yezoensis* (Miyabe) Koidz.

Ezoichige

*Caltha palustris* Linn. var. *barthelii* Hance

Ezonoryûkinka

*Coptis trifolia* (Linn.) Salisb.

Mitsubaôren

*Droseraceae*

*Drosera rotundifolia* Linn.

Môsengoke

*Saxifragaceae*

*Parnassia palustris* Linn.

Umebachisô

*Rosaceae*

*Geum pentapetalum* (Linn.) Makino

Chinguruma

<i>Prunus maximowiczii</i> Rupr.	Miyamazakura
<i>Rubus chamaemorus</i> Linn.	Horomuiichigo
<i>R. pseudo-japonicus</i> Koidz.	Himegoyôichigo
<i>Sorbus commixta</i> Hedl.	Nanakamado
<i>Rutaceae</i>	
<i>Skimia japonica</i> Thunb. var. <i>intermedia</i> Komatsu form.	
<i>repens</i> (Nakai) Owhi	Haishikimi
<i>Aquifoliaceae</i>	
<i>Ilex crenata</i> Thunb. var. <i>paludosa</i> (Nakai) Hara	Hâiinutsuge
<i>I. sugerokii</i> Maxim. var. <i>brevipedunculata</i> (Maxim.) S. Y. Hu	Akaminoinutsuge
<i>Celastraceae</i>	
<i>Euonymus macropterus</i> Rupr.	Hirohatsuribana
<i>Aceraceae</i>	
<i>Acer tschonoskii</i> Maxim.	Minekaede
<i>A. ukurunduense</i> Trautv. et Mey.	Ogarabana
<i>Umbelliferae</i>	
<i>Angelica genuiflexa</i> Nutt.	Ôbasenkyû
<i>Cornaceae</i>	
<i>Cornus canadensis</i> Linn.	Gozentachibana
<i>C. suecica</i> Linn.	Ezogozentachibana

### *Gamopetalae*

<i>Ericaceae</i>	
<i>Andromeda polifolia</i> Linn.	Himeshakunage
<i>Chamaedaphne calyculata</i> Moench.	Horomuitsutsuji
<i>Ledum palustre</i> Linn. var. <i>diversipilosum</i> Makai	Ezoisotsutsuji
<i>Leucothoe grayana</i> Maxim. var. <i>oblongifolia</i> (Miq.) Owhi	Hanahirinoki
<i>Menziesia pentandra</i> Maxim.	Koyôrakutsutsuji
<i>Rhododendron albrechtii</i> Maxim.	Murasakiyashio
<i>R. brachycarpum</i> D. Don	Ezoshakunage
<i>Vaccinium hirtum</i> Thunb.	Usunoki
<i>V. microcarpum</i> Linn.	Himetsurukokemomo
<i>V. ovalifolium</i> J. E. Smith var. <i>coriaceum</i> H. Boiss.	Ezokurousugo
<i>V. oxycoccus</i> Linn.	Turukokemomo
<i>V. praestans</i> Lamb.	Iwatsutsuji
<i>V. smallii</i> A. Gray	Ôbasunoki
<i>V. uliginosum</i> Linn.	Kuromamenoki
<i>Primulaceae</i>	
<i>Trientalis europaea</i> Linn. var. <i>arctica</i> (Fisch.) Ledeb.	Kotusmatorisô
<i>Gentianaceae</i>	
<i>Gentiana triflora</i> Pall. var. <i>horomuiensis</i> (Kudo) Hara	Horomuirindô
<i>Tripterospermum japonicum</i> (Sieb. et Zucc.) Maxim.	Tsururindô

*Labiatae*

*Clinopodium gracile* (Benth.) O. Kunze var. *sachalinense*  
(Fr. Schm.) Ohwi Miyamatôbana

*Lycopus uniflorus* Michx. Ezoshirone

*Caprifoliaceae*

*Viburnum furcatum* Blume Ôkamenoki

*Compositae*

*Aster glehnii* Fr. Schm. Ezogomana

*Ixeris dentata* (Thunb.) Nakai Nigana

*Senecio cannabifolius* Less. Hangonsô

**Monocotyledoneae***Potamogetonaceae*

*Potamogeton fryeri* A. Benn. Futohirimushiro

*Scheuchzeriaceae*

*Scheuchzeria palustris* Linn. Horomuisô

*Gramineae*

*Agrostis scabra* Willd. Ezonukabo

*Calamagrostis langsdorffii* (Link) Trin. Iwanogariyasu

*Moliniopsis japonica* (Hack.) Hayata Numagaya

*Phragmites australis* W. Clayton Yoshi

*Sasa kurilensis* (Rupr.) Makino et Shibata Chishimazasa

*Cyperaceae*

*Carex limosa* Linn. Yachisuge

*C. middendorffii* Fr. Schm. Horomuisuge

*C. omiana* Franch. et Savat. Yachikawazusuge

*C. pauciflora* Lightf. Migaerisuge

*C. rhynchophysa* C. A. Mey. Ôkasasuge

*C. sachalinensis* Fr. Schm. Gongensuge

*C. stipata* Muhlenb. Ôkawazusuge

*C. tenuiflora* Wahlenb. Ipponsuge

*C. traiziscana* Fr. Schm. Hirohaozenumasuge

*Eriophorum vaginatum* Linn. Watasuge

*Rhynchospora alba* (Linn.) Vahl Mikazukigusa

*Eriocaulaceae*

*Eriocaulon sachalinense* Miyabe et Nakai Krafutohoshikusa

*Juncaceae*

*Juncus effusus* Linn. var. *decipiens* Buchen. Igusa

*Liliaceae*

*Heloniopsis orientalis* (Thunb.) C. Tanaka Shôjyôbakama

*Hemerocallis middendorffii* Trautv. et Mey. Ezozeiteika

*Hosta rectifolia* Nakai Tachigiboushi

<i>H. rectifolia</i> Nakai var. <i>atropurpurea</i> (Nakai) Tatewaki et Kawano	Kurobanatachigiboushi
<i>Maianthemum dilatatum</i> (Wood) Nels. et Macbr.	Maizurusô
<i>Trillium kamtschaticum</i> Pall.	Ôbananoenreisô
<i>Veratrum grandiflorum</i> (Maxim.) Loes. fil.	Baikeisô
<i>Araceae</i>	
<i>Lysichiton camtschaticense</i> (Linn.) Schott	Mizubashô
<i>Orchidaceae</i>	
<i>Listera nipponica</i> Makino	Miyamafutabaran
<i>Platanthera mandrinorum</i> Reichb. fil. var. <i>brachycentron</i> (Franch. et Sav.) Koidz.	Yamasagisô
<i>P. tipuloides</i> Lindl. var. <i>nipponica</i> (Makino) Ohwi	Kobanotonbosô
<i>P. tipuloides</i> Lindl. var. <i>tipuloides</i>	Hosobanokisochidori
<i>Pogonia japonica</i> Reichb. fil.	Tokisô
<i>Pog. japonica</i> Reichb. fil form. <i>pallescens</i> Tatewaki	Shirobanatokisô
<i>Tultis ussuriensis</i> (Regel) Hara	Tonbosô

### 3. Enumeration of plant communities

#### HYDROPHYTE COMMUNITIES

##### Submerged plant communities

1. *Batrachospermum vagi* Ito & Umezawa 1970, nom. prov.
  - a. *Batrachospermum vagum* soc. Ito & Umezawa 1970

##### Floating-leaf communities

2. *Nymphaetum tetragonae* auctt.: Ito & Umezawa 1970; Ito & Tachibana 1985
  - b. *Nymphaea tetragona* soc. Ito & Umezawa 1969; Ito & Tachibana 1985
3. *Potamogetum fryeri* Ito & Umezawa 1970
  - c. *Potamogeton fryeri* soc. Ito & Umezawa 1970

#### MOSS VEGETATION

##### Hollow plant communities

4. *Caricetum limosae* Miyawaki *et al.* 1967: Ito & Umezawa 1970
  - d. *Carex limosa* soc. Ito & Umezawa 1970
  - e. *C. limosa*-*Eriocaulon sachalinense* soc. Ito & Umezawa 1970
5. *Scheuchzerio-Rhynchosporium albae boreale* Ito & Umezawa 1970
  - f. *C. limosa*-*R. alba*-*Sphagnum apiculatum* soc. Ito & Umezawa 1970
  - g. *C. limosa*-*R. alba*-*Sphag. pulchrum* soc. Ito & Tachibana 1985
  - h. *Scheuchzeria palustris*-*R. alba* soc. Ito & Umezawa 1970, Ito & Tachibana 1985
6. *Moliniopsido japonicae-Rhynchosporium albae* Ko. Ito, assoc. nov., sed nom. prov.



- i. Moliniopsis japonica-R. alba soc. Ito & Umezawa 1970
- 7. *Geo-Rhynchosoretum albae* Ko. Ito, assoc. nov., sed nom. prov.
- j. Geum pentapetalum-R. alba soc. Ito & Umezawa 1970

### Hummock plant communities

- 8. *Sphagnetum papilloso* Miyawaki *et al.* 1967: Ito & Umezawa 1970. = *Rubochamaemori-Sphagnetum papilloso* Miyawaki & Ohba 1970: Ito & Tachibana 1985.
  - k. Sphagnum magellanicum soc. Ito & Tachibana 1985
  - l. Sph. papillosum soc. Ito & Umezawa 1970: Ito & Tachibana 1985
  - m. R. alba-Sph. papillosum soc. Ito & Umezawa 1970: Ito & Tachibana 1985
- 9. *Ledo-Sphagnetum fusci* Miyawaki & Ohba 1970: Ito & Tachibana 1985. = *Sphagnetum fusci* acutt.: *Vaccinio-Caricetum middendorffii sensu* Ito & Umezawa 1970, non. Suz.-Tok. p. p. minor.
  - n. Sph. fuscum soc. Ito & Tachibana 1985
- 10. *Vaccinio-Caricetum middendorffii* (Suz.-Tok.) Ito & Umezawa 1970. = *Oxycocco-Caricetum middendorffii* Suz.-Tok. 1964.
  - o. Carex middendorffii-Sph. rubellum soc. Ito & Tachibana 1985 (*Vaccinium oxycoccus-C. middendorffii* soc. Ito & Umezawa 1970, p. p. minor.)
  - p. C. middendorffii-R. alba-Sph. tenellum soc. Ito & Tachibana 1985 (*Vac. oxycoccus-C. middendorffii* soc. Ito & Umezawa 1970, p. p. minor.)
  - q. V. oxycoccus-C. middendorffii soc. Ito & Umezawa 1970.
- 11. *Carici-Moliniopsidetum japonicae* Miyawaki, Itow & Okuda 1967
  - r. Myrica gale var. tomentosa-Geum pentapetalum-C. middendorffii soc. Ito & Umezawa 1970: Ito & Tachibana 1985
  - s. Ledum palustre var. diversipilosum-C. middendorffii soc. Ito & Umezawa 1970: Ito & Tachibana 1985
  - t. G. pentapetalum-C. middendorffii soc. Ito & Umezawa 1970
  - u. Osmundastrum cinnamomeum var. fokiense-C. middendorffii soc. Ito & Umezawa 1970: Ito & Tachibana 1985
  - v. Hosta rectifolia var. atropurpurea-C. middendorffii soc. Ito & Tachibana 1985
- 12. *Geo-Cladonietum* Ko. Ito, assoc. nov. 1970
  - w. G. pentapetalum-Cladonia spp. soc. Ito & Umezawa 1970: Ito & Tachibana 1985

## FEN VEGETATION

### Macroherbaceous communities

- 13. *Phragmitetum australis* auctt. = *Phragmitetum communis* auctt. = *Phragmitetum oseaum* Suz.-Tok. 1954
  - x. Phragmites australis soc.: Ito & Tachibana 1985
  - y. Calamagrostis langsdorffii soc. Ito & Umezawa 1970
  - z. Hemerocalis middendorffii-Phragmites australis soc. Ito & Umezawa 1970

## FOREST VEGETATION

14. *Ledo-Piceetum glehnii* Ito & Umezawa 1970, nom. prov. sine diagn. sp.: Ito & Tachibana 1985
- aa. *Picea glehnii*-*Ilex sugerokii* var. *brevipedunculata*-*C. middendorffii* soc. Ito & Umezawa 1970: Ito & Tachibana 1985
- ab. *P. glehnii*-*L. palustre* var. *diversipilosum*-*C. middendorffii* soc. Ito & Umezawa 1970

## 4. Discussion and Conclusion

In a previous work (Ito and Umezawa 1970), Ito calculated a similarity coefficient (Czekanowski 1913, accord. to Greig-Smith 1964). The results were shown in the species combination with high coefficients such as *Carex limosa*-*Rhynchospora alba*, *R. alba*-*Drosera rotundifolia*-*Vaccinium oxycoccus* (incl. *V. microcarpum*), *Carex middendorffii*-*V. oxycoccus*, *C. middendorffii*-*Hosta rectifolia* var. *atropurpurea*. Here, *C. limosa* and *R. alba* form a *C. limosa*-*R. alba* soc. in hollow parts, and the former is a major species in the *Caricetum limosae*, and the latter is one in the *Scheuchzerio-Rhynchosporietum albae boreale*. *Carex middendorffii*, *V. oxycoccus*, and *H. rectifolia* var. *atropurpurea* are species commonly found in hummock parts, and the former two species are the character species of the *Vaccinio-Caricetum middendorffii*, and the rest is one of the physiognomically important species of that association. Close combination of those species indicates the skeleton of spontaneous vegetation in Ukijima mire.

The *Caricetum limosae* and the *Scheuchzerio-Rhynchosporietum* are conservationally important communities, because they are the representatives of mire vegetation developed under extremely wet conditions; they are communities which have been maintained in a dynamic balance between water circulation and peat accumulation (development); and they are less resistant to the treading or the trampling. In fact, frequent treadings have led to the destruction and deterioration of some communities of this mire including those associations and the *Sphagnetum*. When man encroaches the edge of ponds and walks through the carpet of *Sphagna* without caution, floating islets covered with the *Sphagnetum* and those associations easily disappear. Areas and communities which are affected by this kind of impact are gradually increasing and have metamorphosed from natural vegetation to a plantless peat mass in landscape as seen in Figures 2 to 5.

In 1985, we designed a scale of how to evaluate the damage caused by the treading. Ito called it "degree of muddiness" or "Nukarumi-Do", and defined 5 grades of the degree, which can be evaluated by perception of muddy conditions, when man walks through a community cover.

A principle of the degree of muddiness is based on the fact that the surface of wetlands is usually wet but organized by accumulated peat layers so that it is easily modified into disorganized and muddy conditions by the disturbance of man's impacts such as the treading resulting from mechanical pressures of pressing, twisting, sliding, digging of the surface layer of wetlands. Muddiness of the surface

of wetlands is thought to be an expression of man's impacts caused by walking or treading in comparison to normal, undisturbed condition of the surface layer.

According to the degree of muddiness as shown in Table 1, evaluation of the damage was measured along a trail, which leads from the southern entrance of the mire, usually called "Nakakoshi Entrance", to the center of the mire as shown in Figure 1. The total length of trail was 438.3 m, and the result is shown in Table 2.

**Table 1.** Five grades of the degree of muddiness

Grades	Contents
1	The earth surface is normal or nearly normal, hard or soft; the damage of vegetation is very low and the stripping of surface layer by man's impacts are limited or none.
2	The surface is nearly normal, hard or soft; the stripping of surface layer is recognizable, but the vegetation is mostly sound.
3	The surface is becoming soft; the stripping of surface layer is conspicuous, and the vegetation is damaged.
4	The surface is quagmire; the vegetation is vanishing.
5	The surface is completely muddy, and walking is impossible; the vegetation is disintegrated with or without fragmentations of the components.

**Table 2.** Frequencies of Degree of muddiness along a trail from the southern entrance to the center of mire

Grades of degree of muddiness	No. of samples*	Length (m)	Percentages (%)**
1	13	29.7	6.8
2	29	137.8	31.4
3	24	76.5	17.5
4	25	114.7	26.2
5	5	79.6	18.2

\* sample area:  $1 \times 1 \text{ m}^2$

\*\* Length occupied by a given degree of muddiness/Total length (438.3 m)  $\times 100(\%)$

Furthermore, Table 3 shows that the relations of the degree of muddiness to plants.

Table 2 shows that percentages of the degree of muddiness from 4 to 5 are 44% of the total length of trail; the so-called fragile vegetation has been considerably destroyed and the habitat is too muddy to walk through the mire on foot. It means that half of the trail was across a fragile vegetation which is mostly composed of the hummock-hollow system, when the Forestry Office designated this mire as a recreation forest. As a result of repeated treading of the designated course of the trail by visitors who view and enjoy the mire landscape, the course was stripped of its surface layer and become barren with mud (Figure 2). In

**Table 3.** Frequencies of main plants in each degree of muddiness

Degree of muddiness	Weak ←—————→ Strong					Frequencies of all samples (96)
	1	2	3	4	5	
No. of samples	13	29	24	25	5	
No. of species	21	25	14	14	7	
Species						
<i>Hosta rectifolia</i> var. <i>atropurpurea</i>	53.8%	37.9%	16.7%	12.0%	40.0%	29.2%
<i>Gentiana triflora</i> form. <i>horomuiensis</i>	23.1	20.7	8.3	0	20.0	12.5
<i>Carex middendorffii</i>	100.0	55.2	41.7	28.0	0	20.0
<i>Rhynchospora alba</i>	46.2	48.3	54.2	68.0	60.0	56.3
<i>Scheuchzeria palustris</i>	15.4	6.9	16.7	36.0	6.0	20.8
<i>Sphagnum papillosum</i>	53.8	10.3	20.8	20.0	0	20.8
<i>Geum pentapetalum</i>	100.0	48.3	33.3	0	0	37.5
<i>Vaccinium oxycoccus</i>	23.1	13.8	0	8.0	0	9.4
<i>Coptis trifolia</i>	7.7	17.2	4.2	0	0	7.3
<i>Eriophorum vaginatum</i>	15.4	0	4.2	4.0	0	4.2
<i>Moliniopsis japonica</i>	7.0	10.3	0	4.0	0	5.2
<i>Carex omiana</i>	0	13.8	4.2	20.0	0	10.4
<i>Solidago virga-aurea</i> var. <i>leiocarpa</i>	7.7	3.4	0	0	0	2.1
<i>Andromeda polifolia</i>	30.8	3.4	0	0	0	5.2
<i>Ledum palustre</i> var. <i>diversipilosum</i>	15.4	10.3	0	0	0	5.2
<i>Carex limosa</i>	0	0	8.3	20.0	40.0	9.4
<i>Eriocaulon sachalinense</i>	0	0	0	4.0	20.0	2.1
<i>Lysichiton camtschaticense</i>	0	0	0	4.0	20.0	2.1

spring when melting water floods the mire, or after showers, this course becomes a water course, and the vegetation and the surface layer was eroded to lead to a complete disappearance of the vegetation and to a modification of topography (Figure 3).

Table 3 shows that different plants react to impacts by man in different manners. Most plants, however, decrease their survival percentages from weak impacts to strong impacts as seen in such plants as *Carex middendorffii*, *Geum pentapetalum* (although this plant is not a mire plant), *Sphagnum papillosum*, but some have survived strong impacts as seen in *Carex limosa* and *Rhynchospora alba*, which are plants with lower vitality.

Through the field observation and examination of the Tables communities which are most susceptible to the treading are the Caricetum limosae, and the Scheuchzerio-Rhynchosporietum albae boreale (Figures 4 and 5). The typical association of ponds, the Nyphaetum tetragonae, is affected by erosion of boggy surface: lower transparency resulted from the suspension of minute particles. The Sphagnetea are considerably damaged by the treading: barren moss carpet, and invasion of extra-Sphagnetea plants from outside of the association.

At the present time, those associations are the most notable communities from the point of view of nature conservation. It, however, is fortunate that the damage is not so serious, and the vegetation may survive for a while. A suitable treatment

carried out in the Ozegahara mire by Tachibana *et al.* (Tachibana 1976) will be a great help to repair the affected areas or parts of the vegetation.

There are several ways to evaluate the importance of species from a conservation point of view. In 1978, Shimizu *et al.* attempted to set forth an objective standard of important species in a conservational sense. In this attempt it was stressed that the standard should be based on the score method, in which several items were selected as follows: (1) number of individuals, (2) attribution to any vegetation type, (3) dimensions or areas of the vegetation type attributed, (4) propagation capacity, (5) life-form, (6) geographical range, (7) importance of the taxonomical group including a given species, (8) fluctuation of number of individuals during the latest several years, (9) possible danger of allowing a species to be extinguished from the original habitat, and (10) significance of a given species for rare animals co-existed. In every case, 5 classes are defined, ranging from 1 to 5. Although Ito took part in this plan, he was hardly agreeable to this method, because items to be selected will increase indefinitely according to our evolving knowledge of plants, and because the whole is not the sum of parts as the ecological principle states. We think that the total evaluation of a species is essential in this case, and that simple is best.

In *Nature Conservation Review* edited by Ratcliffe (1977), reviewers showed that the grading of sites resulted from the comparison of site qualities among similar types of sites. Items cited are (1) size or extent, (2) diversity, (3) naturalness, (4) rarity, (5) fragility, (6) typicalness, (7) recorded history, (8) position in an ecological/geographical unit, (9) potential value, and (10) intrinsic appeal. Despite numerous items, complexity was avoided by giving a clear description of each category. They calculated variety of sites according to 4 degrees of grade, from grade 1 to 4.

In particular, we think that the following are in agreement with our opinion: the present view is an attempt to prescribe the contemporaneous requirement for conservation of special sites according to current values, views, information and constraints. However, elaborate the rationalisations which might be made to justify the way it has been done, it would be wrong to disclaim the element of intuition involved, though one hopes that this is built on awareness and experience. The method of evaluation and site election used in the *Review* are therefore provisional and pragmatic, and dictated especially by incompleteness of survey information and the need to produce a working report within a reasonable time. Urgency and realism rather than theory and idealism have been the keynote of the operation. (p. 14).

In 1981, Russian botanists, S. S. Xarievich and N. N. Kachura proposed six standards for selection of species to protect for nature conservation as follows:

**0:** *near extinct*; species which gradually decrease in the nature or grow in a specific inaccessible habitat or have been maintained themselves in cultivation.

**1:** *endangered*; species which are facing extinction, and which could not survive if special care is not provided.

**2:** *rare*; species which are quantitatively decreasing and are narrowing the

habitat range. If care is not given, they will disappear in a short time.

3: *decreasing*; species which are decreasing in quantity and in habitat ranges year by year owing to anthropogenic or spontaneous causes.

4: *unstable*; species where there is a possibility of extinction, but there is no accurate information of the exact status of species at the present time.

5: *stable*; species which are not threatened or may not decrease for a while.

The standards are built up by a simple principle. And they require more precise field works for the purpose of this kind of effort for the selection of important species for nature conservation in their book.

Rapoport, et al. (1986) mathematically designed a conservational value of species ( $V_s$ ) as follows:

$$V_s = V_a \times V_c \times V_f$$

Where  $V_a$  is the degree of occupation of each species in the grid set up on a given nature reserve;  $V_c$  is the continental value, a measure of the geographic range of species;  $V_f$  is frequency or abundance value in this conservational values. The main constraint is the geographic range of species and the density of each species, which is substitutionable with qualitative indices, when there is no numerical data.

This is a very simple and effective method to assess an important species in the plan of nature reservation in a definite area.

In Flora of Shiraishi City (1983), we can find the simplest standard for selecting important species. Although this standard is limited to a local flora, the simplicity is best in the overviewing of the conservational status of a species. It is characteristic of a non-hierarchical standards, which are distinguished by 8 categories from A to G. Important species are judged by a single category such as A, or F, or G, in one case but are designated by a combination of several categories such as (A, B and E), (A, B, E, F and G) in the other case. Those standards are rather excellent in practice than complex standards in concept.

In Ukijima mire, man's impacts on the vegetation are low at present. However, several species are suffering from unreasonable and unpleasant activities of man such as a forced walk through the Sphagnetea as a result of issuing passes to the visitors by the Forestry Office without any consideration of the nature of wetlands and outright theft of dwarf-formed plants of *Picea glehnii* for the *Bonsai* by *Bonsai* lovers. Therefore, first, our attention should be centered on protection of plants from damage of the treading and outright theft of plants including the *Bonsai* plant. We are attempting to design a repair plan of deteriorated areas of the mire according to Tachibana's work in Ozegahara mire (1976), that is, a kind of experiment on ecosystem, or ecotechnological experiment prepared by Ito. Secondly, we set the following categories for the conservation of the mire species in this area in a form of very easily understandable simple expression based on the principle that all species on the earth are endangered today.

A. *Noticeable species in taxonomy and phytogeography*. *Cornus suecica* Linn. (limited distribution in Hokkaido), *Vaccinium microcarpum* Linn. (limited

distribution in Hokkaido), *Lycopodium inundatum* Linn. (limited distribution in Hokkaido), *Eriocaulon sachalinense* Miyabe et Nakai (limited distribution in Hokkaido and rare species in Japan; this species has been reported on this site in Hokkaido, but its taxonomical position is not clear, because a Russian author considers it to be identical with *Eriocaulon atrum* Nakai [Woroschilov 1966 and 1982]).

**B. Valuable species for conservation:** *Sphagnum* species, which are low resistant to man's impacts, and which are intolerant to eutrophication of mires.

**C. Endangered or threatened species:** No species are included in this category at present, but *Sphagnum* species and *Bonsai* form of *Picea glehnii* are most likely to be endangered in the near future as far as man's impacts increase.

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**Photo 2.** A bird's-eye view of Higashi-Ohnuma pond area of Ukijima mire from a research balloon at a height of ca. 300 m. Bare walk surrounds the regeneration complex composed of the *Scheuchzerio-Rhynchosporium albae boreale*, the *Sphagnetum papillosum*, and the *Sphagnetum fuscum*. (by courtesy of the PASCO, 3 Aug. 1985).



**Photo 3.** A muddy path becomes the water course after a shower. (photo by Ito, 11 Sept. 1985).





**Photo 4.** Barren vegetation on the shore of Ohnuma pond. (photo by Ito, 11 Sept. 1985).



**Photo 5.** Floating islets on Ohnuma pond, of which vegetation has been completely damaged by the treading. (photo by Ito, 11 Sept. 1985).