

## Ecological study of the flora at Tumen river area, border of North Korea and China

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(Manuscript received 4 December, 2002 ; accepted 23 January, 2003)

This study was executed by China along with the Tumen river, which formed border of North Korea and China. As a result 91 family, 282 genera, 363 species, 57 variety 4 species, total 424 taxa of vascular plants were identified. The examination area was include the region that had various vegetation such as upper swampy land, seashore dune, a river, a high mountain grassy plain, deciduous tree zone, evergreen coniferous forest zone. The followings are representative plants, which found in an examination area but not in South Korea. *Picea koraiensis*, *Larix gmelini* var. *principis-ruprechtii*, *Betula platyphylla*, *Ulmus pumila*, *Populus koreana*, *Ledum palustre* var. *diversipilosum*, *Rhododendron parvifolium*, *Salix brachypoda*, *Phacelurus latifolius*, *Carex gotoi*, *Carex capricornis*, *Calla palustris*, *Aquilegia flabellata* var. *pumila*, *Lilium davuricum*, *Astragalus membranaceus*, *Trifolium lupinaster*, *Ledebouriella seselodes*, *Polemonium racemosum*, *Scutellaria baicalensis*, *Linnaea borealis*, *Thladiantha dubia*, *Inula helenium*, *Trollius hondoensis*, *Hypochaeris ciliata*, *Aconitum kirinense*, *Aconitum arcuatum*, *Potentilla viscosa* var. *macrophylla*. And there are 21 rare and endangered species, which Korean Forest Service designated, such as *Aconitum koreanum*, *Acorus calamus* var. *angustatus*, *Polygonatum stenophyllum*, *Drosera rotundifolia*, *Iris setosa*, *Jeffersonia dubia*, *Lilium davuricum*, *Lilium cernum*, *Paeonia obovata*, *Penthorum chinense*, *Phacelurus latifolius*, *Rosa marretii*, *Sparganium stoloniferum*, *Thymus quinquecostatus*, *Trillium tschonoskii*, *Utricularia japonica*, *Tripterospermum japonicum*, *Vaccinium uliginosum*, *Vaccinium vitis-idaea*, etc. Especially, plants like, *Acanthopanax senticosus*, *Jeffersonia dubia* and *Lilium cernum* which have high values of ornamental, and medical use are in an extinction crisis. High swampy land was formed to upper stream of Tumen river. It showed representative vegetation, like *Carex* sp., *Scirpus radicans*, *Eriophorum latifolium*. Wetlands plant and a dune plant were mixed in down stream area of Tumen river. On a dune, seashore plants, such as *Carex kobomugi*, *Salsola collina*, *Raphanus sativus* var. *raphanistroides*, *Rosa rugosa*, *Scutellaria strigillosa*, *Linaria japonica*, *Phacelurus latifolius* were appeared frequently.

Key words : Vascular plants, Vegetation, Endangered species, Wetland

### 1. Introduction

Recently, internationals promote national core assignment to excavate and preserve natural resources, in order to maximize national interests by development and utilization of biological genetic resources. Through CBD, UPOV, WIPO international society, advocate to strengthen the intellectual property right, and protect the

independent rights of the nation who possessed of resources.

In our country, there are growing concern of development and preservation of native plant resources, but national strategy and policy, social industry yet could not approach the fact. And if this negative confrontation consist, we will be faced with influence of seeds war. Therefore, urgent things to prepare for biological genetic resources war for the 21th century is work to establish a maintenance base of a various genetic resources by searching and collecting of foreign and domestic biological resources. Examination area, border of Tumen

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river where lived Korean residents in China, maximum minority group in China, have long history of coexistence of Korean and Chinese, also have common tradition and culture about utilization of native natural resources. Therefore, it have important meaning when it considers to be relate with plants in Korea<sup>1)</sup>. During the researches, there was a lot of trouble by division to north and south. Recently, North Korean plants were introduced to us by few researchers who investigate the plants in Mt. Changbai through China<sup>2)</sup>. Therefore, this survey was conducted with the following purpose. Investigation of economically valuable plant genetic resources of the northeast China area which have same flora, and the environmental condition as in Korean peninsula<sup>3)</sup>. For the South and North Korea unitary time to approach, establish grounding data of various plant resources in border area so find the effective development and management plan. Check the botanical ecology of border area and investigate the environment condition systematically.

## 2. Materials and Methods

This examination was carried out over 25-30 in July, 20-24 of September, 7-9 of December in 2001 years by 3 times. Survey was carried out from Wentsu where source of Tumen river, trough Chongshan, Sanhe, Tumen, Hunchun and Bangchuan area, the border line with Russia. The examination include investigation of a local flora in 30 location where the vegetation was characteristic specimen and follower collection are also carried with site and an environment factors(Table 1). Locations of surveyed area are marked using Global Position System(GPS III, Plus, USA) and coordinates by a hyper-unit in 0.1. As for the environment factors, a height above the sea level altitude, a direction, a brightness, a sergeant, decayed soil depth, the soil pH, soil hardness, soil character were investigated, too(Table 2)<sup>4)</sup>. Examination for object plants were focused on plant which have ornamental, medical and genetical value, and native plant species which are not grow in South Korea. The data are classified as following, species distributed over North Korea and China hardly in south Korea, species distributed only in China, a rare variety,

endangered species in Korea, useful plant resources, and other peculiarity<sup>5)</sup>.

## 3. Results and Discussion

In this study, 91 family, 282 genus, 57 variety 4 subspecies total 424 taxa of plants were identified. Despite of special conditions called China and North Korea border line, limit of road condition and movement and in bad weather condition and short schedule, various species were investigated. This survey areas have various ecological characteristics such as

Table 1. Latitude and longitude in surveyed areas in China

Survey area number	Place name	Latitude	Longitude
1	Seungri	42°42' 08.0" N	129°29' 24.8" E
2	Changchai	42°39' 48.5" N	129°39' 48.5" E
3	Cheungnan	42°34' 34.4" N	129°33' 22.0" E
4	Kunsilieshan	42°33' 35.5" N	129°33' 15.7" E
5	Kunsilieshan	42°33' 32.1" N	129°33' 13.9" E
6	Tumen	42°46' 48.1" N	129°47' 42.1" E
7	Tumen	42°51' 16.6" N	129°49' 03.5" E
8	Jemanjun	42°54' 03.4" N	129°48' 01.9" E
9	Heuanshan	43°01' 09.2" N	129°51' 58.3" E
10	Heuanshan	43°01' 28.6" N	129°51' 28.5" E
11	Bangchuan	42°26' 14.7" N	130°34' 55.9" E
12	Sandhill	42°27' 10.6" N	130°34' 31.9" E
13	Lotus park	42°27' 35.9" N	130°35' 13.8" E
14	Tumanriver	42°36' 02.3" N	130°31' 56.8" E
15	Lungjing	42°49' 48.8" N	129°23' 50.4" E
16	Lungjing	42°49' 16.0" N	129°24' 01.7" E
17	Taguanling	42°10' 43.6" N	129°04' 54.0" E
18	Kwangping	42°03' 41.5" N	128°50' 05.1" E
19	Kwangping	42°03' 38.9" N	128°46' 54.6" E
20	Kwangping	42°05' 25.1" N	128°43' 29.7" E
21	Outskirts of Changbai retreat	42°13' 11.2" N	128°10' 43.8" E
22	Laohuangungpu	42°09' 20.7" N	128°20' 33.9" E
23	Laohuangungpu	42°09' 20.7" N	128°20' 33.9" E
24	Laohuangungpu	42°09' 21.4" N	128°20' 29.7" E
25	Laohuangungpu	42°09' 21.4" N	128°20' 29.7" E
26	Laohuangungpu	42°07' 18.8" N	128°22' 39.9" E
27	Wentsu	42°01' 46.1" N	128°26' 11.2" E
28	Wentsu	42°01' 46.1" N	128°26' 11.2" E
29	Helung	42°31' 11.2" N	128°36' 20.8" E
30	Laoling	42°31' 09.1" N	128°36' 19.8" E

high moor, seashore dune, wetlands, a high mountain grassy plain, deciduous broad-leaved forest, coniferous forest, mixed forest, vegetation of roadside, etc. If time allows, a close survey of these area will be needed to confirm more species and build up ecological data.

Important plants such as *Jeffersonia dubia*,

*Lilium cernum*, *Lilium destichum*, *Lilium davuricum*, *Lychnis fulgens*, *Paeonia obovata* were confirmed in Mt. Kunsileshan, deforestation and virgin forest, *Thymus quinquecostatus*, *Rhapontica uniflora*, *Scutellaria baicalensis*, *Trollius hon-doensis*, *Hypochaeris ciliata*, etc. were appeared in Mt. Heuan, a high mountain grassy plain in

Table 2. Physical features and stratum of each surveyed areas

Survey area number	Aspect	Altitude (m)	Slope (°)	Soil texture	Soil pH	Soil hardness (mm)	Humus stratum (cm)	Light intensity
1	S	200	0	Clay loam	5.9	15	1	Sunshine
2	SE	260	3	Clay loam	5.9	11	10	Sunshine
3	NW	510	8	Sandy soil	6.6	26	20	Sunshine
4	SE	700	11	Sandy soil	6.4	15	15	Semi sunshine
5	NE	720	48	Clay loam	7.0	19	5	Shade
6	SE	20	5	Sandy loam	6.5	12	5	Semi sunshine
7	E	20	0	Loam	5.4	-	-	Sunshine
8	SE	25	8	Clay loam	4.8	12	10	Sunshine
9	N	450	10	Sandy loam	6.6	11	5	Sunshine
10	NW	380	32	Sand	6.5	7	1	Semi sunshine
11	NE	5	0	Loam	6.8	11	5	Sunshine
12	E	5	3	Sandy clay	6.2	6	1	Sunshine
13	NW	12	13	Clay loam	6.2	14	7	Sunshine
14	NE	25	3	Sandy soil	6.9	6	0	Sunshine
15	NW	350	3	Clay loam	5.4	6	0	Sunshine
16	NW	352	7	Clay loam	5.4	14	10	Semi sunshine
17	W	420	32	Clay loam	6.4	4	10	Semi sunshine
18	NE	892	8	Clay loam	6.2	17	20	Semi sunshine
19	SW	800	3	peat	5.4	-	-	Sunshine
20	SE	790	3	peat	5.0	-	-	Sunshine
21	NW	890	5	Sandy loam	6.5	12	10	Shade
22	S	1,070	5	peat	5.5	-	-	Sunshine
23	S	1,070	5	peat	5.5	26	20	Sunshine
24	S	1,070	3	Clay loam	5.8	20	15	Semi sunshine
25	S	1,070	2	peat	5.8	-	-	Semi sunshine
26	SE	1,120	5	Volcano soil	6.0	6	0	Sunshine
27	E	1,190	0	peat	5.0	-	-	Sunshine
28	S	1,190	2	peat	5.8	-	-	Sunshine
29	SW	1,100	10	Lithosol	6.5	15	5	Shade
30	NW	1,050	12	Lithosol	6.5	17	10	Shade

Tumen city.

Also, in 12th survey area, where a dune and wetlands adjoined, seashore plant like, *Carex kobomugi*, *Linaria japonica*, *Rosa rugosa* and wetland plant, like *Acorus calamus* var. *angustatus*, *Lythrum anceps*, *Juncus effusus* var. *decipiens*, *Carex* sp., dryland plants, such as *Orostachys* sp. and *Orostachys japonicus* were distributed. In Laohuangshungpu, the edge of Mt. Changbai, well developed high moor were formed in many places, and various wetland plants, such as, *Utricularia japonica*, *Myriophyllum verticillatum*, *Carex arenicola*, *Carex dispalata*, *Epilobium angustifolium*, *Sparganium stoloniferum*, *Eriophorum vaginatum*, *Ledum palustre* var. *diversipilosum*, *Vaccinium vitis-idaea*, *Linnaea borealis*, etc. were in appearance.

Because of high latitudes to reach 42~43° the north latitude in this examination area, it is remarkably isolated from South Korea geographically<sup>6)</sup>.

Therefore, a lot of plant species show a difference, especially *Picea koraiensis*, *Larix gmelini* var. *principis-ruprechtii*, *Betula platyphylla*, *Ulmus pumila*, *Populus koreana* as a vigorous high tree, and shrubs like, *Ledum palustre* var. *diversipilosum*, *Rhododendron parvifolium*, *Salix brachypoda* and *Phacelurus latifolius* are representative species. Among them, evergreen *Ledum palustre* var. *diversipilosum*, and *Rhododendron parvifolium* has good fragrance, it will be ideal for pot plant. As a herbaceous plants, *Carex gotoi*, *Carex capricornis*, *Eriophorum latifolium*, *Eriophorum vaginatum*, *Lilium davuricum*, *Calla palustris*, *Aquilegia flabellata* var. *pumila*, *Mitella nuda*, *Astragalus membranaceus*, *Trifolium lupinaster*, *Euphorbia lucorum*, *Ledebouriella seselodeds*, *Polemonium racemosum*, *Scutellaria baicalensis*, *Linnaea borealis*, *Thladiantha dubia*, *Inula helenium*, *Trollius hondoensis*, *Hypochaeris ciliata*, *Aconitum kirinense*, *Aconitum arcuatum* and *Potentilla viscosa* var. *macrophylla* are not distributed or hardly founded in South Korea. *Eriophorum vaginatum*, *Lilium davuricum*, *Calla palustris*, *Aquilegia flabellata* var. *pumila*, *Polemonium racemosum*, *Scutellaria baicalensis*, *Trollius hondoensis*, *Hypochaeris ciliata*, etc. are valuable to develop ornamental plant, and *Astragalus membranaceus*, *Euphorbia lucorum*, *Ledebouriella seselodeds*,

*Scutellaria baicalensis*, *Inula helenium*, *Aconitum kirinense*, *Aconitum arcuatum* are used as a medical plant, so it is valuable for plant resources<sup>7)</sup>.

Total, 21 rare and endangered species designated by Korean Forest Service were identified such as, *Aconitum koreanum*, *Vaccinium vitis-idaea*, *Acanthopanax senticosus*. Especially, *Jeffersonia dubia* and *Lilium cernum* have outstanding ornamental value so their population is decreasing rapidly and *Paeonia obovata*, *Polygonatum stenophyllum*, which has high value of medical use, is almost in endangered (Table 3). In this survey area, a change of an environment or the direct damage by deforestation, rather not by interference by human being was most, but damage of rare plant was concerned by expansion of farmland in wetland and expansion of road. Also, it is necessary that genetic relationship or morphological differences between plant species, found in this study, and domestic plant species<sup>8)</sup>.

Table 3. The rare and endangered plants around Tumen river

Scientific name	Surveyed area number
<i>Sparganium stoloniferum</i>	7, 20
<i>Phacelurus latifolius</i>	11
<i>Acorus calamus</i> var. <i>angustatus</i>	12, 14, 15
<i>Lilium davuricum</i>	4, 5
<i>Lilium cernum</i>	4
<i>Lilium distichum</i>	4, 5, 18
<i>Polygonatum stenophyllum</i>	12
<i>Trillium tschonoskii</i>	29
<i>Iris dichotoma</i>	24
<i>Aconitum koreanum</i>	9
<i>Paeonia obovata</i>	5, 18
<i>Jeffersonia dubia</i>	4
<i>Drosera rotundifolia</i>	27
<i>Rosa marretii</i>	18, 26
<i>Penthorum chinense</i>	2
<i>Acanthopanax senticosus</i>	5, 29, 30
<i>Vaccinium uliginosum</i>	22, 26, 28
<i>Vaccinium vitis-idaea</i>	22, 26, 28
<i>Tripterospermum japonicum</i>	18
<i>Thymus quinquecostatus</i>	9
<i>Utricularia japonica</i>	7, 22

Among the plant which confirmed in this survey, *Eriophorum vaginatum*, *Calla palustris*, *Lilium davuricum*, *Lilium cernuum*, *Iris uniflora* var. *carinata*, *Aquilegia flabellata* var. *pumila*, *Caltha palustris* var. *membranacea*, *Jeffersonia dubia*, *Sedum spectabile*, *Orostachys* sp. and *Rosa marretii* has the high ornamental value. Also, the plants like *Acorus calamus* var. *angustatus*, *Polygonatum stenophyllum*, *Paeonia lactiflora*, *Astragalus membranaceus*, *Euphorbia lucorum*, *Acanthopanax sessilifloru*, *Acanthopanax senticosus*, *Bupleurum falcatum*, *Scutellaria baicalensis*, *Gentiana scabra* var. *buergeri* are useful for medicine. And edible plant, like *Ledum palustre* var. *diversipilosum*, *Rhododendron parvifolium*, *Vaccinium uliginosum* are hardly found in South Korea.

Wetlands were widely developed around a China side on Tumen river source (Table 4). With a flora examination, set up the 10 examination in this survey plot, examined the sociability and coverage of an appearance species. This vegetation is unique, we can hardly found in South Korea besides Yongnup located in 1,200m altitude of Mt. Daiam. The wetlands around the sources of Tumen river are developed in Wentsu, Laohuangungpu, and Kwangping at altitude 790m~1,300m among the subalpine zone forest, like *Larix gmelini* var. *principis-ruprechtii* or *Betula platyphylla* community ranges from dozens of to several hundred of forest. The wetlands soil is forming muck peat thickly, the following is parent rock material which are composed of the clay, and impermeable layer<sup>9)</sup>. Soil pH of the muck peat was examined about acidity with 5.0~6.0 and except Wentsu which was a volcano, it showed a slow incline with 3~5°. At the large scale of wetlands in the source of Tumen river, Wentsu, Laohuangungpu, and Kwangping several ponds were developed. There lived many floating leaf plants like, *Utricularia japonica*, *Chara braunii*, *Myriophyllum verticillatum*, etc., which are submerged plant and various emergent anchored hydrophytes such as *Phragmites communis*, *Typha orientalis*, *Scirpus tabernaemontani*, *Sparganium stoloniferum*, *Sparganium angustifolium*, *Alisma plantaga-aquatica* var. *orientale*, *Scirpus radicans*, *Triglochin maritimum*, etc. This is similar to vegetation of Japanese high mountain wetlands,

but stocks of *Brasenia schreberi*, *Potamogeton distinctus*, *Nymphaea tetragona* var. *angusta*, *Trapa japonica* which are observed commonly in Japan, didn't appear.

Experimental area 1(42° 03' 38.9" N, 128° 46' 54.6" E), 4 (42° 09' 20.7" N, 128° 20' 33.9" E), and 9(42° 01' 46.1" N, 128° 26' 11.2" E) belongs to low moor in these points. Low moors, the early stage of wetland development process, is the stage, that community of reeds forms muck peat layer to a pond or a lake so plant like *Carex arenicola* and other *Carex* sp. are grow. The following is the plant commonly appeared in experimental area, and low moors in Japan; *Lobelia sessilifolia*, *Ligularia jaluensis*, *Cicuta virosa*, in survey area 1, *Carex jaluensis*, sphagnum moss, in area 4, *Phragmites communis*, *Typha orientalis*, *Scirpus tabernaemontani*, *Calamagrostis langsdorffi*, and *Osmunda cinnamomea* var. *fokiensis* in area 9. Characteristic plants of lower moor in source of Tumen river area are *Phacelurus latifolius*, *Salix brachypoda*, etc. those are dwarfed woody plants which were hardly seen in South Korea. However, *Phacelurus latifolius* and *Salix brachypoda* were found in water canal where abundant in dissolved oxygen. So there was less relationship with lower wetland where rush peat were developed.

Experimental area 2 (42° 05' 25.1" N, 128° 43' 29.7" E) and 5 (42° 09' 20.7" N, 128° 20' 33.9" E), 7 (42° 09' 21.4" N, 128° 20' 29.7" E), 8 (42° 01' 46.1" N, 128° 26' 11.2" E) are located in the center or the edge in experimental area 1, 4, 9, which are lower moor and different plant species are appeared than other lower moor. In experimental area 2, the coverage of *Eriophorum latifolium* and *Carex* sp., *Ledum palustre* var. *decumbens* and sphagnum moss in area 5, *Carex arenicola*, *Eriophorum vaginatum*, sphagnum moss in area 7, *Molinia japonica*, *Eriophorum vaginatum*, *Drosera rotundifolia* in area 8 were high. Comparing with the coverage of Japanese wetlands is high so it correspond to the middle moors or high moor. And *Molinia japonica* is an index plant in Japanese middle moor. *Molinia japonica* appears in lower moor, but if it grow, converted land progresses gradually because of sedimentation of muck peat. In stock



Table 4. The composition of species in Wetlands around Tumen river (continued)

Survey plot	3	6	10	4	5	7	8	2	1	9	No. of appearance
<b>Herb layer</b>											
<i>Calamagrostis langsdorffi</i>	.	1. 2	+	1. 2	1. 2	.	.	1. 2	1. 2	.	6
<i>Carex</i> sp.	+ 2	.	.	.	.	.	.	2. 2	4. 4	.	3
<i>Eriophorum vaginatum</i>	.	.	.	.	.	2. 2	3. 3	3. 3	.	.	3
<i>Vaccinium vitis-idaea</i>	.	2. 2	1. 2	+	.	.	.	.	.	.	3
<i>Carex arenicola</i>	.	.	.	+	.	2. 2	2. 2	.	.	.	3
<i>Carex meyerina</i>	.	.	.	.	.	.	+	.	+ 2	.	2
<i>Ligularia jaluensis</i>	.	.	.	.	.	.	.	+ 2	+ 2	.	2
<i>Gentiana triflora</i>	.	.	.	.	.	.	.	.	+ 2	+	2
<i>Saussurea amurensis</i>	.	.	.	.	.	.	.	.	+	+	2
<i>Ostericum maximowiczii</i>	.	.	.	+	.	.	.	.	+	.	2
<i>Lobelia sessilifolia</i>	.	.	.	.	.	.	.	.	+	1. 2	2
<i>Typha orientalis</i>	.	.	.	.	.	.	.	+	.	+	2
<i>Sanguisorba stipulata</i>	.	+ 2	.	.	.	.	.	+	.	.	2
<i>Sanguisorba tenuifolia</i> var. <i>alba</i>	.	.	.	.	.	.	+	+	.	.	2
<i>Osmunda cinnamomea</i> var. <i>fokiensis</i>	+	.	.	.	.	.	.	.	.	1. 2	2
<i>Pteridium aquilinum</i> var. <i>latiusculum</i>	+	.	+ 2	.	.	.	.	.	.	.	2
<i>Linnaea borealis</i>	.	+ 2	.	.	+ 2	.	.	.	.	.	2
<i>Sedum viviparum</i>	.	.	.	.	.	.	.	.	+	.	1
<i>Galium verum</i> var. <i>asiaticum</i>	.	.	.	.	.	.	.	.	+	.	1
<i>Parnassia palustris</i>	.	.	.	.	.	.	.	.	+	.	1
<i>Iris ensata</i> var. <i>spontanea</i>	.	.	.	.	.	.	.	.	+	.	1
<i>Caltha palustris</i> var. <i>membranacea</i>	.	.	.	.	.	.	.	.	+ 2	.	1
<i>Vicia cracca</i>	.	.	.	.	.	.	.	.	+	.	1
<i>Lythrum anceps</i>	.	.	.	.	.	.	.	.	1. 2	.	1
<i>Cicuta virosa</i>	.	.	.	.	.	.	.	.	+	.	1
<i>Chara braunii</i>	.	.	.	.	.	.	.	+	.	.	1
<i>Lysimachia vulgaris</i> var. <i>davurica</i>	.	.	.	.	.	.	.	+	.	.	1
<i>Equisetum hyemale</i>	2. 2	.	.	.	.	.	.	.	.	.	1
<i>Bupleurum longiradiatum</i>	+	.	.	.	.	.	.	.	.	.	1
<i>Solidago virga-aurea</i> var. <i>asiatica</i>	+	.	.	.	.	.	.	.	.	.	1
<i>Carex dispalata</i>	.	.	.	2. 2	.	.	.	.	.	.	1
<i>Sparganium angustifolium</i>	.	.	.	+	.	.	.	.	.	.	1
<i>Eriocaulon miquelianum</i>	.	.	.	+	.	.	.	.	.	.	1
<i>Epilobium angustifolium</i>	.	.	.	+	.	.	.	.	.	.	1
<i>Alisma plantago-aquatica</i> var. <i>orientale</i>	.	.	.	+	.	.	.	.	.	.	1
<i>Scirpus radicans</i>	.	.	.	1. 2	.	.	.	.	.	.	1
<i>Utricularia japonica</i>	.	.	.	+	.	.	.	.	.	.	1
<i>Iris setosa</i>	.	+	.	.	.	.	.	.	.	.	1
<i>Drosera rotundifolia</i>	.	.	.	.	.	.	+ 2	.	.	.	1
<i>Triglochin maritimum</i>	.	.	.	.	.	.	+	.	.	.	1
<i>Scirpus triquetter</i>	.	.	.	.	.	.	.	.	.	2. 2	1
<i>Potamogeton distinctus</i>	.	.	.	.	.	.	.	.	.	+	1
<i>Phragmites japonica</i>	.	.	.	.	.	.	.	.	.	2. 2	1
<i>Latua sibirica</i>	.	.	.	.	.	.	.	.	.	+	1
<i>Phragmites communis</i>	.	.	.	.	.	.	.	.	.	+	1
<i>Scirpus tabernaemontani</i>	.	.	.	.	.	.	.	.	.	+	1
<i>Angelica anomala</i>	.	.	+	.	.	.	.	.	.	.	1

Rare species(Plot number):

*Tilia amurensis*+(3), *Pinus koraiensis*+(3), *Ledum palustre* var. *decumbens*+(10), *Achillea ptarmica* var. *acuminata*+(1), *Galiopsis bifida*+(1), *Persicaria sieboldii*+(4), *Myriophyllum verticillatum*+(4), *Hypericum ascyron*+(4).

of *Molinia japonica*, the coverage of sphagnum moss is so high and spread through cushion figure that makes a scaffold of upper wetland. Besides *Molinia japonica*, the representative plants of the middle moor includes *Eriophorum vaginatum*, *Ledum palustre* var. *diversipilosum*, *Osmunda cinnamomea* var. *fokiensis*, *Drosera rotundifolia*. If these plant make independence or mixed stock it will be the middle moor. In Japan, *Oxycoccus quadripetalus* is reported, but did not appear in this examination area. *Linnaea borealis* which appear in experimental area 5 is characteristic<sup>10)</sup>. The coverage of tall tree, *Larix gmelini* var. *principis-ruprechtii*, and *Betula platyphylla*, is low but appeared which is disproving more converted land than lower moor.

In experimental area 3 (42° 13' 11.2" N, 128° 10' 43.8" E), 6 (42° 09' 21.4" N, 128° 20' 29.7" E), 10 (42° 01' 46.1" N, 128° 26' 11.2" E) unlike wetland which was explained before, shrubs and tall trees appeared statiform and forming woods to the edge of wetlands. In experimental area 3, 6, and 10, *Larix gmelini* var. *principis-ruprechtii* appeared with all high coverage, and *Betula platyphylla*, *Populus maximowiczii*, in area 3, *Betula ermani* in area 6 were appeared. Also, it is noticeable that *Ledum palustre* var. *diversipilosum*, *Vaccinium vitis-idaea* in area 6 and *Rhododendron parvifolium*, *Vaccinium vitis-idaea*, *Vaccinium uliginosum*, in area 10 make a large population in the lower layer of hydrophyten community.

There were many area that wetlands and a dune appear together in down stream of Tumen

River. It seemed having become wetlands as an overflowing of a river or crescent lake of meander but later covered by lots of sand, it showed wetlands plant and a dune plant.

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