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Vegetation of Notsuke Sand Spit (1)-Community descriptions*

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野付崎の植生—群落記述

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Summary

Notsukezaki or Notsuke shingle spit, Prov. Nemuro, extending from 43° 33′ to 43°38′ NL and 145°11′ to 145° 21′ EL, has been utilized for domestic animals for a long time since the end of the preceding Century. At present the Notsukezaki vegetation is semi-natural. The present anthor investigated the vegetation of Notsukezaki from the phytosociological view-point extending over a period of 4 summers of 1959, 1970, 1971 and 1972. Patterned communities are as follows; I. Shingle beach vegetation: *Mertensia maritima* var. *asiatica* community, II. Foredune vegetation: *Elymus mollis* com., III. General coastal meadow: *Rosa rugosa* dominant com., *Agrostis alba–Trifolium repens* com., and *Thermopsis lupinoides* facies, IV. Shingle salt marsh vegetation: *Zostera marina* sociation, *Triglochin maritimum* soc., *Salicornia europaea–Spergularia marina* var. *asiatica* soc., *Puccinellia kurilensis* soc., *Carex subspathacea* soc., *Glaux maritima* var. *obtusifolia* soc., and *Juncus gracillimus* · *J. haenkei–Potentilla egedei* var. *groenlandica* soc., V. Bogs with Sphagna: *Carex limosa–Sphagnum apiculatum* com., *Vaccinium oxycoccus–Sph. magellanicum* com., *Carex koidzumii* com., *Calamagrostis langsdorffii–Sph. palustre* com., VI. Slack vegetation: *Alisma plantago-aquatica* var. *orientale–Hippuris vulgaris* com., *Schoenoplectis tabernaemontanii* com., *Eleocharis mamillata* var. *cyclocarpa–E. kamtschatica* com., and *Carex* com., VII. Forest vegetation: *Betula ermanii–Rhus ambigua* com., *B. ermanii–Acer mono–R. ambigua* com., *B. ermanii–Sorbus commixta–Dryopteris austriaca* com., *B. ermanii–Picea jezoensis–R. ambigua* com., *Fraxinus mandshurica* var. *japonica–Alnus japonica* · *F. mandshurica* var. *japonica* · *Al. japonica–Polygonum thunbergii* com., *F. mandshurica* var. *japonica–Ma-*

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tteuccia struthiopteris com., *Al. japonica–Carex vesicaria* com., *Quercus crispula–R. ambigua* com., *Q. crispula–Fragaria yezoensis* com., *Acer mono–Sasa amphitricha* com., *Abies sachalinensis · B. ermanii · Q. crispula–Ab. sachalinensis–Ab. sachalinensis* com., *Picea jezoensis · Q. crispula–R. ambigua* com., *B. ermanii · Q. crispula · (Ab. sachalinensis)–Ab. sachalinensis–R. ambigua · Maianthemum dilatatum* com., *B. ermanii · P. jezoensis–P. jezoensis–M. dilatatum* com., *Ab. sachalinensis–Ab. sachalinensis–Ab. sachalinensis* com., and *P. jezoensis–D. austriaca* com. In the present paper, details of these communities were not given, because this is a synoptical paper on the community classification.

It was pointed out that human impacts including grazing have strongly affected on the floristic composition of the *Agrostis alba–Trifolium repens* community and that *T. repens* is exclusive to *Plantago camtschatica*, but is associated with *Poa pratensis*. Drastic degeneration of *Rosa rugosa* plants of General coastal meadows was considered to be due to the aging of the plants, and *Thermopsis lupinoides* facies which was established on previous *Rosa* sites was thought to be a substitute communitity of *Rosa rugosa* community.

From a successional point of view, it was concluded that *Agrostis alba–Trifolium repens* community is in a plagioclimax stage, *Quercus crispula* community is in an edaphic climax stage and *Picea jezoensis* community is established as a true climatic climax stage. Notsukezaki area, however, is characterized by the macromosaic arrangement of summer-green forest and boreal coniferous forest communities at the same time as well as in the same dimension. This may be said because the present investigation area ranges within the *Tatewakia* or the Cold Temperate Region.

Preface

The present paper deals with community descriptions. Most of the communities described here were previously published in 1959 and 1970 in Japanese. Some communities were patterned by additional data accumulated in 1971 and 1972. The vegetation is illustrated by physiognomical–physiographical features; shingle beach vegetation, foredune vegetation, general coastal meadows or dune meadows, shingle salt marsh vegetation, bog with Sphagna, slack vegetation and forest vegetation.

The Notsuke shingle spit extends from 43° 33′ to 43° 38′ N and from 145° 11′ to 145° 21′ E. Its shape resembles a hook in appearance with a total coastal length of 26 km, thus being the largest shingle spit in Japan. Its coast-line is very smooth on the Nemuro Strait side (the Pa-

cific side) but is quite irregular on the Notsuke Bay side.

The surrounding geologic formation is a Quaternary—Holocene formation, divided into Notsuke Sand Gravel Bed and Beach Sand Gravel Bed, Peat Beds, and Younger Volcanic Ash. It is surmized that development of this sand spit may have occurred in two stages: beach ridges between Chippukaruusu and Kinachausu or Kimaki, having been formed in the older stage, while beach ridges in apposition between Kinachausu or Ryuzinzaki and Nakashibetsu being younger. The youngest part, however, is the top of the Notsuke shingle spit, which lacks volcanic ash accumulation originating from Mashu or Me-Akan volcanic acitivities which occurred 200 and 500 years ago.

It should be noted that the land submergence on the Bay side has been

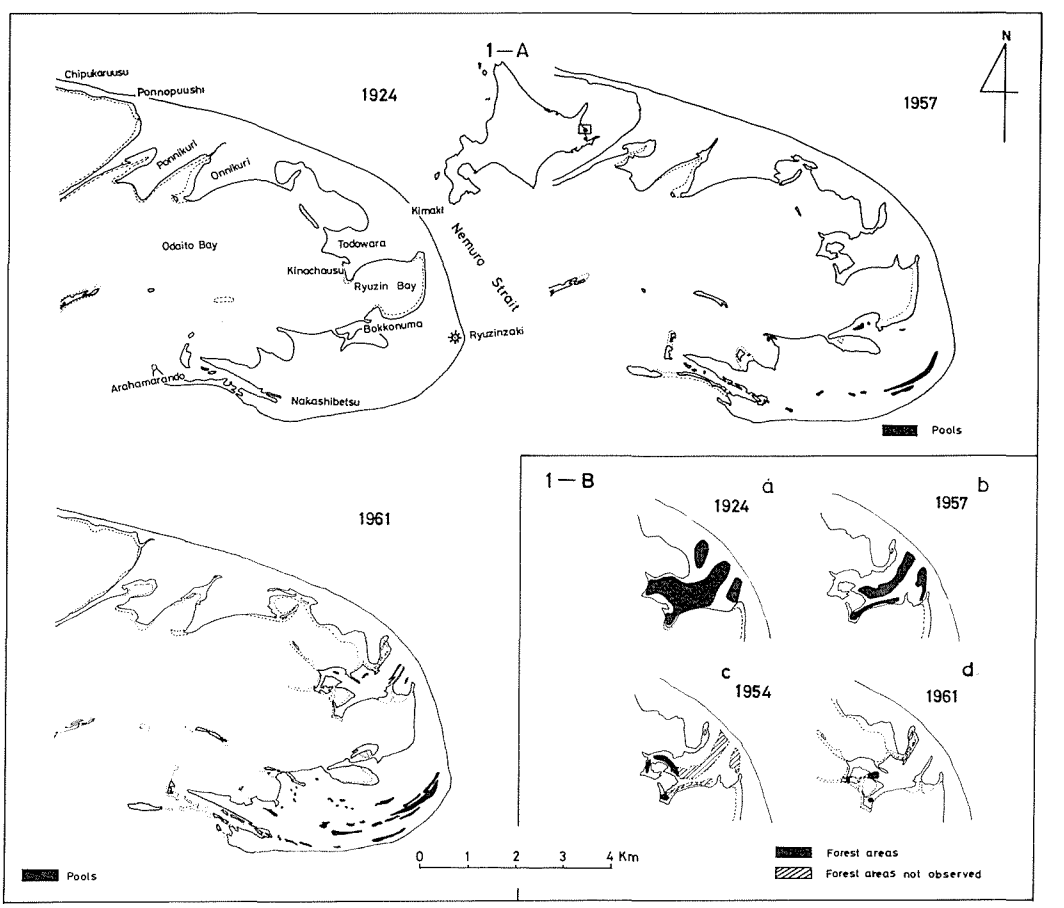


Fig. 1. Changes of the topographic outline and the forest areas of Notsuke Sand Spit
1—A: Comparison of three topographical Maps published in different years; 1924. 1957 & 1961.
1—B: Shrink of the forest areas; a. 1924 & b. 1957, based on Japanese Imperial Land Survey and Geographical Survey Institute c. 1954, based on the author's observation d. 1961, based on GSI.

progressing. The rate of submergence is said to be 1 cm per annum. The actual cause is not revealed as yet. As a result, the land outline has changed during the last 1/2 century. This can be seen by making a comparison between older and recent maps, as shown in fig. 1.

The climate of this area is the Pacific type as seen in the climograph and the hythergraph (fig. 2). It is characterized by wet summers and dry winters. The climate-diagram (fig. 3) shows the climatic characteristics of Nemuro (the Pacific type).

The climatic features of the present area are summarized as follows; 1) the atmospheric temperature is low on the average, 2) the relative humidity and the precipitation are higher in summer than in winter, 3) fine days with severe cold spells are often in winter and 4) frost-free periods are relatively short and heavy soil-freezing prevails in winter.

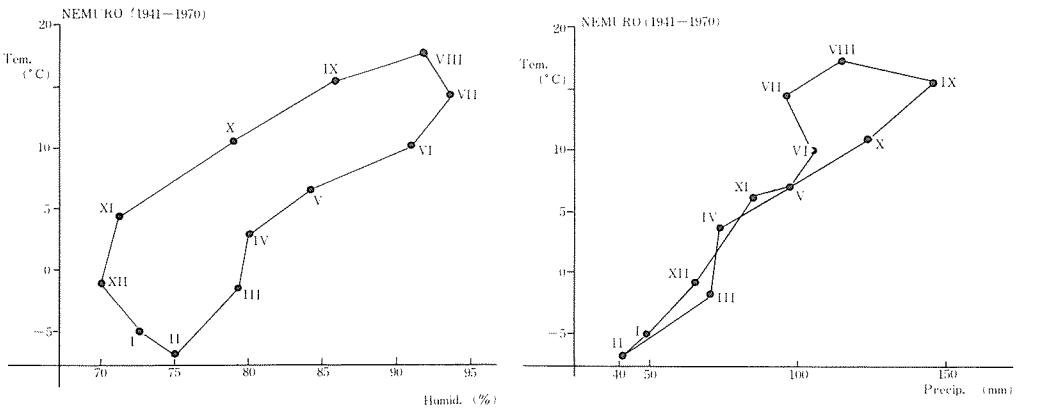


Fig. 2. Climograph and Hythergraph of Nemuro (Data based upon Rika-Nenpyo 1976)

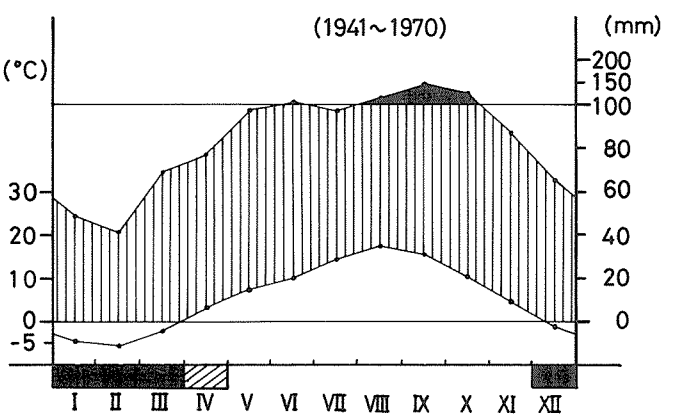


Fig. 3. Climate-diagram of Nemuro (Data based on Rika-Nenppyo 1976)

Brief illustrations of communities

I. Shingle beach vegetation

A shingle beach extends on the Nemuro Strait side. One community, i.e. the *Mertensia maritima* var. *asiatica* community is recognizable in this vegetation (tab. 1).

Table 1. The *Mertensia maritima* var. *asiatica* community in sandy gravel habitats

Quadrat	1	2	3	4
Area (m^2)	9	25	100	100
No. of species	5	5	13	14
Total coverage (%)	75	75	80	80
Rate of beach & foredune elements against total number of species (%)	80	83	54	78
Phenology: Blossom				
Mertensia maritima var. *asiatica*	3	3	3	3
Honkenya peploides	·	·	+	+
Carex macrocephala	·	·	+	+
Artemisia stelleriana	·	·	·	+
Glehnia littoralis	·	·	·	+
Lathyrus maritimus	·	·	·	+
Poa macrocalyx	·	·	+	+
Festuca rubra	·	·	+	·
Puccinellia kurilensis	·	1	1	+
Spergularia marina var. asiatica	·	·	+	·
Stellaria humifusa	·	·	+	·
Phenology: Fruiting				
Carex pumila	·	·	+	+
Phenology: Vegetative				
Linaria japonica	2	2	2	1
Ixeris repens	2	·	+	1
Senecio pseudoarnica	·	1	1	1
Elymus mollis	·	+	·	+
Sonchus brachyotis	·	·	+	·
Rosa rugosa	·	·	·	+
Atriplex gmelinii	+	·	·	·
Seedlings				
Mertensia maritima var. *asiatica*	+	·	·	·
Artemisia stelleriana	+	·	·	·

Stability in habitats increases from Q.1 to Q.4.
Date: 4th July 1972.

As Scott (1963a) stated, *Mertensia maritima* prefers coarse gravel or boulder beaches and often develops on pure shingles with drifts or wracks (cf. Gimingham 1964) . *Mertensia maritima* var. *asiatica* shows the same behavior as that of the mother species in Europe. A typical physiognomy of the present community is found at Arahamarand.

In the floristic composition of the present community, *Mertensia maritima* var. *asiatica* is dominant. The constant species are *Ixeris repens, Linaria japonica* and *Senecio pseudoarnica.* Companions are *Artemisia stelleriana, Carex macrocephala, C. pumila, Elymus mollis, Glehinia littoralis, Honkenya peploides, Lathyrus maritimus, Atriplex gmelinii**, *Puccinellia kurilensis***, *Spergularia marina* var. *asiatica, Stellaria humifusa***, *Festuca rubra****, *Poa macrocalyx****, *Rosa rugosa****, and *Sonchus brachyotis****.

As shown by the species listed above, companions of the present community are composed of shingle beach and foredune elemtnts (no asterisks), wrack elements (*), salt marsh elements (**) and general coastal meadows elements (***).

Mertensia maritima var. *asiatica* or asiatic shore-wort is in full bloom in July and *Senecio pseudoarnica* or sea-shore senecio blossoms in August. As the latter plant attains a height of 1 m in flowering time and overcomes *Mertensia* plants as well as other herbs, the community physiognomy changes in summer from the bluish-purple colored shore-wort dominant aspect to the golden yellow colored sea-shore senecio dominant aspect.

II. Foredune vegetation

Dune formation activity is rather stagnant at present, and development of embryonic dunes of *Elymus* is more or less disturbed by long-term grazing and fishery activities. *Elymus mollis* is an effective dune-builder in Japan. Its ecological role is comparable with that of *Ammo-*

Table 2. The *Elymus mollis* community in the foredune vegetation
[Data are abstracted from a belt-transect (60m long) in every 10th quadrat (1 m²)]

Quadrat (1 × 1) m²	1	10	20	30	40	50	60	F.	C. V.
Elymus mollis	2	2	2	2	2	2	2	V	996
Carex macrocephala	1	1	2	1	2	1	1	V	351
Glehnia littoralis	1	+	+	+	+	+	+	V	
Ixeris repens	1	+	+	+	+	+	+	V	
Linaria japonica	+	+	·	+	+	·	+	IV	
Artemisia stelleriana	·	·	·	+	·	+	·	II	
Lathyrus maritimus	·	·	·	+	·	·	+	II	

Table 3. The *Rosa rugosa* dominant community in the general coastal meadows

Quadrat (1×1) m²	5	6	7	8	9	10	11	12	13	14		
No. of species	12	12	14	17	21	22	12	7	27	19	C.	C.V.
Max. community height (cm)			(60 ~ 90cm tall)						90	80		
Life form: N												
Rosa rugosa	5	5	5	5	3	5	5	5	4	4	V	7750
Sasa amphitricha	+	·	·	·	·	·	·	·	·	·	I	1
Life form: Ch												
Dianthus superbus	·	·	·	·	·	+	+	·	·	·	I	1
Life form: H												
*** *Festuca rubra* var. *rubra*	+	+	2	2	2	2	2	1	2	1	V	1152
*** *Geranium yesoesne* var. *pseudo-palustre*	+	+	+	+	+	+	2	1	1	3	V	656
**** *Fragaria yezoesnis*	+	+	·	2	1	+	4	·	2	1	V	1078
* *Trifoliumrepens* (Ch)	·	·	·	·	+	+	2	2	3	+	III	727
** *Elymus dahuricus*	+	+	+	+	·	+	·	·	+	+	IV	7
** *Agrostis alba*	+	·	+	+	·	·	3	·	·	1	III	428
*** *Agrimonia pilosa* var. *japonica*	+	+	+	+	·	+	·	·	2	+	IV	181
** *Stachys japonica* var. *intermedia*	+	+	+	·	·	·	+	·	+	·	III	5
** *Ranunculus grandis* var. *austrokurilensis*	+	·	·	·	·	+	+	·	·	+	II	4
** *Rubus parvifolius*	·	·	+	2	·	1	·	·	+	·	II	227
*** *Poa pratensis*	·	·	1	1	+	·	·	·	2	3	III	651
** *Calamagrostis epigeios*	·	2	·	+	·	·	·	·	·	·	I	176
**** *Taraxacum shikotanense*	·	+	+	·	·	·	·	1	1	+	III	103
** *Galium verum* var. *trachycarpum*	·	+	·	·	·	+	+	·	+	·	II	4
*** *Viola langsdorffii*	·	·	·	+	+	+	·	·	+	·	II	4
** *Miscanthus sinensis*	·	·	+	1	·	·	·	·	·	+	II	52
** *Bromus pauciflorus*	+	·	·	·	·	+	·	·	·	·	I	2
* *Halenia corniculata*	·	+	·	·	+	·	·	·	+	·	II	3
**** *Viola mandshurica*	·	+	·	·	·	·	·	·	+	+	II	3
** *Calamagorstis langsdorffii* f. *pilosa*	·	·	+	·	·	+	·	·	·	·	I	2
* *Artemisia koidzumii*	·	·	+	·	·	+	·	·	·	·	I	2
* *Achillea ptarmica* var. *macrocephala*	·	·	+	·	+	·	·	·	+	·	II	3
* *Thalictrum minus* var. *hypoleucum*	·	·	·	+	·	·	·	·	+	·	I	2
**** *Taraxacum officinale*	·	·	·	·	+	·	·	·	+	·	I	2
*** *Geum aleppicum*	·	·	·	·	+	·	·	·	+	+	II	3
*** *Carex gmelinii*	·	·	·	·	+	·	3	·	·	1	II	426
*** *Sanguisorba tenuifolia*	·	·	·	·	+	·	·	·	+	·	I	2
*** *Brachypodium sylvaticum*	·	·	·	·	·	2	·	·	+	+	II	177
** *Scutellaria strigiosa*	·	·	·	·	·	+	·	·	·	+	I	2
** *Asperula odorata*	·	·	·	·	·	+	·	·	·	+	I	2
** *Pedicularis resupinata*	·	·	·	·	·	+	·	·	+	·	I	2
** *Lathyrus palustris* var. *pilosus*	·	·	·	·	·	·	+	·	+	·	I	2
*** *Carex caryophyllea* var *microtricha*	·	·	·	·	·	·	·	·	·	2	I	175
*** *Poa macrocalyx*	·	·	·	·	·	·	·	3	·	·	I	375
** *Vicia cracca*	·	·	·	+	·	·	·	·	·	·	I	1
*** *Viola verecunda*	·	·	·	+	·	·	·	·	·	·	I	1
** *Phleum pratense*	·	·	·	·	+	·	·	·	·	·	I	1
**** *Plantago camtschatica*	·	·	·	·	+	·	·	·	·	·	I	1
** *Agrostis scabra*	·	·	·	·	+	·	·	·	·	·	I	1
* *Cerastium holosteoides* var. *hallaisanense*	·	·	·	·	+	·	·	·	·	·	I	1
** *Moehringia lateriflora*	·	·	·	·	·	·	·	+	·	·	I	1
* *Anaphalis margaritacea* var. *angustior*	·	·	·	·	·	+	·	·	·	·	I	1
* *Stellaria radians*	·	·	·	·	·	+	·	·	·	·	I	1
* *Artemisia montana*	·	·	·	·	·	·	·	·	+	·	I	1
Life form: G												
Artemisia japonica	+	·	·	·	·	·	·	·	·	·	I	1
Asperula odorata	·	·	·	+	·	·	·	·	·	·	I	1
Thermopsis lupinoides	·	·	·	+	3	1	·	·	1	·	II	476
Adenphora triphylla var. *japonica*	·	·	·	·	+	·	·	·	+	·	I	2
Maianthemum dilatatum	·	·	·	·	+	·	·	·	·	·	I	1
Polygonatum humile	·	·	·	·	·	·	·	·	+	·	I	1
Life form: Th												
Euphrasia maximowiczii var. *yezoensis*	·	·	·	·	+	·	·	·	·	·	I	1

* H, ** Hp, *** Hs & **** Hr.

phila arenaria in European sand dune system. *E. mollis* prefers the "finer fraction components" (Scott 1963 a) and establishes a community on half-stable sand dune habitats. Although the original status of the community has been modified to an extent by human impacts, especially long-term fishery activities, a subnatural physiognomy remains on Ponnopuushi.

In the floristic composition of the present community, the dominant species is *E. mollis*. The constant species are *Glehnia littoralis*, *Ixeris repens* and *Carex macrocephala* (tab. 2). Companions are *Artemisia stelleriana*, *Carex pumila*, *Honkenya peploides*, *Lathyrus maritimus* and *Rosa rugosa*. Pure stands of *C. pumila* or Kobosuge sedge are often present, but it is assumed that they are seminatural in origin, since Kobosuge sedge prefers to form colonies in sites where sand dunes have been cut off and arranged by fishermen for use as net-drying and net-fixing areas.

Tüxen (1966) described the Soncho brachyotis–Elymetum mollis representing sea-shore vegetation in N. Japan.

III. General coastal meadows

In Hokkaido, coastal meadows have mostly been used for cattle-grazing. Thus, communities which belong to General coastal meadows have been to a certain extent established under human impacts. The present vegetation is very distant from the foredune *Elymus* community which was mentioned already. Differences are as follows: 1) in this vegetation the species diversity increases, 2) *E. mollis* is greatly reduced in vigour (cf. Tatewaki and Leu 1960) as *Ammophila arenaria* in Scotland (Gimingham 1964), and 3) *Rosa rugosa* is the dominant species and characterizes the vegetation physiognomy.

General coastal meadows are developed on a narrow sand ridge between Ponnopuushi and Kinachausu, and on beach ridges in apposition between Kinachausu and Nakashibetsu. Three communities are recognizable in the meadow system, the *Rosa rugosa* dominant community (tab. 3), the *Agrostis alba–Trifolium repens* community (tabs. 4, 5, and 6), and the *Thermopsis lupinoides* facies.

The *R. rugosa* dominant community is established under light grazing conditions and develops from the crest to the rear slopes of the dune ridges. *R. rugosa* or Hamanasu rose is the physiognomically dominant species which forms the first layer in stratification, and usually some grasses and sedges grow up through broad-leaved Hamanasu rose. They are *Carex gmelinii*, *Festuca rubra* var. *rubra*, *Poa macrocalyx* var. *scabriflora* and *P. pratensis*. Understories consist of one or two layers in which

Table 4. The Grasses type of *Agrostis alba–Trifolium repens* community in general coastal meadows

Quadrat (1×1) m²	15	16	17	18	19	20	C.	C.V.
No. of Species	4	4	7	10	9	6		
Max. community height (cm)			(40 ~ 60cm tall)					
Agrostis alba	4	4	5	5	5	5	V	7917
Festuca rubra var. *rubra*	1	2	·	1	1	·	IV	542
Poa pratensis	·	·	2	1	+	·	III	377
Phleum pratense	·	·	·	+	+	·	II	3
Carex gmelinii	·	·	+	·	·	·	I	2
Trifolium repens	·	·	·	+	+	+	III	5
Plantago camtschatica	1	1	2	+	2	+	V	753
Geranium yesoense var. *pseudopalustre*	1	1	·	+	1	1	V	335
Fragaria yezoensis	·	·	+	+	·	+	III	5
Viola mandshurica	·	·	+	+	+	·	III	5
Agrimonia pilosa var. *japonica*	·	·	·	+	+	+	III	5
Potentilla stolonifera	·	·	+	·	·	·	I	2

Table 6. The Forbs type of *Agrostis alba–Trifolium repens* community in general coastal meadows

Quadrat (1×1) m²	26	27	28	29	30	31	32	33	C.	C.V.
No. of Species	7	6	7	7	4	7	7	7		
Max. community height (cm)				(12 ~ 40cm tall)						
Agrostis alba	1	+	·	+	·	·	·	2	III	284
Carex caryophyllea var. *microtricha*	1	+	1	·	·	·	·	·	II	126
Festuca rubra var. *rubra*	1	·	1	2	1	+	2	1	V	689
Poa pratensis	1	1	1	+	·	1	+	·	IV	253
Phleum pratense	·	·	·	·	·	+	·	·	I	1
Trifolium repens	1	·	1	·	·	3	4	5	IV	2469
Plantago camtschatica	5	5	4	4	5	3	2	+	V	5533
Geranium yesoense var. *pseudoplaustre*	+	+	+	+	+	·	·	3	IV	475
Fragaria yezoensis	·	·	+	+	+	+	+	2	IV	225
Taraxacum shikotanense	·	·	·	·	·	+	+	+	II	4
Viola mandshurica	·	·	·	·	·	·	+	·	I	1
Potentilla stolonifera	·	3	·	+	·	·	·	·	II	470

various kinds of herbs occur to varying degrees of dominancy and frequency. The number of plants which can be found varies according to the thickness of the leaf canopy of *R. rugosa*. When the canopy is thin and light intensity penetrating into understories is high, the species density increases. But, when the canopy is thick and the light intensity is low,

Table 5. The Grasses-Forbs type of *Agrostis alba* -*Trifolium repens* community in general coastal meadows

Quadrat (1×1) m²	21	22	23	24	25	34	35	36	C.	C.V.
No. of Species	5	6	4	8	11	10	12	13		
Max. community height (cm)	(20 ~ 50cm tall)									
Agrostis alba	·	+	+	2	2	3	3	3	V	1846
Carex caryophyllea var. *microtricha*	·	·	1	+	·	·	2	+	III	284
Festuca rubra var. *rubra*	+	·	·	·	2	3	1	+	IV	753
Poa pratensis	2	3	2	3	3	+	1	·	V	1908
Trifolium repens	5	4	5	4	5	·	2	3	V	5531
Plantago camtschatica	·	+	·	1	+	+	2	3	IV	754
Geranium yesoense var. *pseudoplalustre*	·	·	·	+	1	5	2	+	IV	1378
Ranunculus grandis var. *austrokurilensis*	·	·	·	+	+	+	+	+	IV	6
Fragaria yezoensis	·	·	·	·	·	·	1	+	II	64
Taraxacum shikotanense	·	·	·	·	1	·	·	·	I	63
Viola mandshurica	·	·	·	·	1	+	+	+	III	66
Galium verum var. *trachycarpum*	·	·	·	·	·	·	+	·	I	1
Moehringia lateriflora	·	·	·	·	·	+	·	+	II	3
Agrimonia pilosa var. *japonica*	·	·	·	·	·	·	+	·	I	1
Euphrasia yezoensis	·	·	·	·	·	·	·	2	I	219
Scutellaria strigillosa	·	·	·	·	·	+	·	+	II	3
Miscanthus sinensis	·	·	·	·	·	+	·	·	I	1
Hypericum yezoense	·	·	·	·	·	·	·	+	I	1
Potentilla stolonifera	·	·	·	+	+	·	·	·	II	3
Rosa rugosa	·	·	·	·	1	·	·	·	I	63
Plantago asiatica	+	·	·	·	·	·	·	·	I	1
Taraxacum officinale	+	+	·	·	·	·	·	·	II	3
Cerastium caespitosum var. *ianthes*	·	+	·	·	·	·	·	·	I	1

the species density decreases. Fluctuations of the number of species found in the *R. rugosa* dominant community depend on the degree of vitality and ages of *R. rugosa* plants, and sometimes on the grazing pressure exerted in the past, or existing at present.

In the floristic composition, the dominant species is *R. rugosa*, and the co-dominant species is *Poa macrocalyx* var. *scabriflora* and/or *Poa pratensis*. The constant species are *Agrimonia pilosa* var. *japonica*, *Festuca rubra* var. *rubra*, *Fragaria yezoensis**, *Geranium yesoense* var. *pseudopalustre**, and *Trifolium repens***. Among them, *A. pilosa* var. *japonica* is a weedy and grazing indicator plant, *Festuca* etc. (*) are native plants and

Trifolium repens (**) is a cultivated forb. Companions are *Agrostis alba**, *Elymus dahuricus**, *Halenia corniculata**, *Ranunculus grandis* var. *austro-kurilensis**, *Stachys japonica* var. *intermedia**, *Taraxacum shikotanense**, *Viola acuminata** etc.

The *Agrostis alba–Trifoliun repens* community is the most popular community under grazing conditions in Hokkaido (Tatewaki et al. 1956). In Notsukezaki, the present community occupies level, or more or less flat grounds of dune ridges. Stands belonging to this community in the present area may be divided into three types, although they are not necessarily sharp in demarcation. They are a grasses type, a grasses–forbs type and a forbs type. In the first type, *Agrostis alba* is dominant and two species of Gramineae, *Festuca rubra* var. *rubra* and *Poa pratensis*, are commonly conspicuous. Forbs are generally inconspicuous, but such plants as *Geranium yesoense* var. *pseudopalustre* and *Plantago camtschatica* are commonly associated. In the second type, its floristic composition is intermediate between the first type and the third type, and its physiognomical aspect consists of *Poa pratensis* and *Trifolium repens*. In addition to them *Agrostis alba* and *Plantago camtschatica* are prevailing in the same stand, but their dominancies are suppressed. Viewing the three tables and fig. 4, it appears to provide a fact that *Trifolium repens* is exclusive to *Plantago camtschatica* in occurrence and that the former plant is associated with *Poa pratensis*. The fact mentioned above is caused by the difference of growth form among three species. *Trifolium repens* or white clover shows a procumbent type in growth form which is highly competitive to that of *Plantago camtschatica* or Camtschatica plantain which shows a rosette

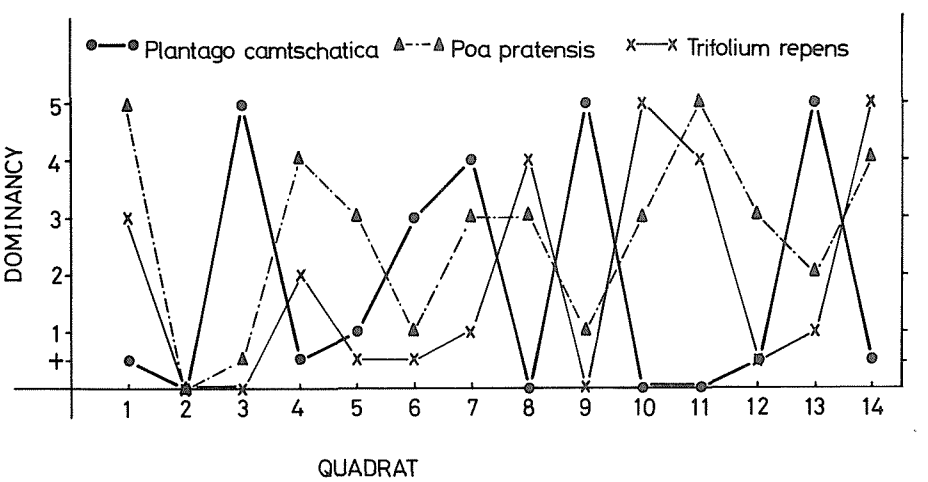


Fig. 4. Dominancy fluctuation of 3 specis of *Agrostis alba–Trifolium repens* community in Notsukezaki

type. *Poa pratensis* or Kentucky blue grass shows an erect type of growth form and is less competitive to *T. repens*, because the former plant can grow through small pockets of the foliage of the latter plant. In the third type, *Plantago camtschatica* is dominant, and various grasses degenerate considerably in dominancy.

Including the three types of stands mentioned above, the leading species in the floristic composition of this community are *Agrostis alba* or red top, *Trifolium repens* and *Plantago camtschatica*. *Festuca rubra* var. *rubra*, *Fragaria yezoensis*, *Geranium yesoense* var. *pseudopalustre*, and *Poa pratensis* are constantly found. Companions are *Agrimonia pilosa* var. *japonica*, *Carex caryophyllea* var. *microtricha*, *C. gmelinii*, *Potentilla stolonifera*, *Ranunculus grandis* var. *austrokurilensis*, *Taraxacum shikotanense*, *Viola mandshurica* etc.

Drastic degeneration of some *Rosa rugosa* plants has been often found in Notsukezaki. The cause of this is not clear as yet, but one of the reasons may be over-harvesting of the rose flowers to make oil essential for perfumes. It is also thought by a zoologist that field mice cause considerable damage to the root systems of *Rosa rugosa* plants (Kobayashi in oral discussion). Dead individuals of *R. rugosa* are found in some stands, but at the same time the seedlings of *R. rugosa* are found on the ground layer of the stands. Thus, the author considers that senescence of *R. rugosa* plants is due to the aging of the plants. Degeneration of *R. rugosa* seems to allow a temporary invasion of *Thermopsis lupinoides* into the previous *R. rugosa* dominant community and results in new establishment of the *Thermopsis lupinoides* facies. Thus, the author thinks that the *Thermopsis lupinoides* facies is a substitute community for the *Rosa rugosa* dominant community.

A typical physiognomy of the present facies is found on a median beach ridge of beach ridges in apposition, and the spring aspect is very excellent for sight-seeing.

IV. Shingle salt marsh vegetation

As Gimingham stated (1964), shingle salt marsh vegetation is constantly found along inner sea coasts where muddy matrix and a high degree of salinity are maintained.

In the present area, this shingle salt marsh vegetation develops along an irregular inner sea coast (the Bay side). Detailed studies on this vegetation were carried out by the present author and published in 1961 and 1963 (cf. tab. 7). The studies were based exclusively on the belt-transect method, and seven sociations were described. They are the *Zostera marina* sociation, the *Triglochin maritimum* soc., the *Salicornia europaea–Spergu-*

Table 7. Shingle salt-marsh vegetation (habitual changes from the seaside to the inland) [modified from an original belt-transect (130×1) m² in 1963]

Distance from the initial point (seaside) (m): / Quadrat area (1×1) m²	1 ⟩ 26	27 ⟩ 36	37 ⟩ 64	65 ⟩ 95	95 ⟩ 118	119 ⟩ 130	C.
No. of Species	*1(−2)	2	3(−4)	4(−5)	4(−5)	7	
***Eu-meso halobious							
Triglochin maritimum	**+−2(−4) 92.3%	(+−)3−4 100%	2 − 5 100%	(1−)2−4 100%	(+−)1−3 100%	+ - 1 91.7%	V
****Euhalobious							
Salicornia europaea	(+) 3.8%	+ 100%	+−1 100%	1 − 3 100%	(+−)1−3 100%	+(−1) 66.7%	V
Spergularia marina var. *asiatica*	·	·	+(−1) 85.7%	+− 1 96.7%	+ 25 %	+ 25 %	III
Puccinellia kurilensis	·	·	(+) 3.6%	+(−1) 93.3%	+− 2 100%	(+−) 5 100%	IV
***Meso-oligohalobious							
Glaux maritima var. *obtusifolia*	·	·	·	(+) 3.3%	(+) 7.7%	+− 1 58.3%	II
Oligo-halobious							
Potentilla egedei var. *groenlandica*	·	·	·	·	·	+(−4) 75 %	I
Stellaria humifusa	·	·	·	·	·	+ 25 %	I

Habitat pecularities
1. Seaside ⟷ Inland
2. Strong ⟵ Wave action ⟶ Weak or not
3. Increasing ⟵ Salinity ⟶ Decreasing
4. Muddy, submerged ⟷ Sandy. not submerged

* ( ) : rare or very rare in frequency

**: range of coverage / frequency

*** : Mikkelsen, V. (1949); Ecological studies of the salt marsh vegetation in Isefjord. pp. 18−22

**** : Iversen according to Mikkelsen (1949).

laria marina var. *asiatica* soc., the *Puccinellia kurilensis* soc., the *Carex subspathacea* soc., the *Glaux maritima* var. *obtusifolia* soc., and the *Juncus gracillimus* · *J. haenkei*−*Potentilla egedei* var. *groenlandica* soc.

Representatives of them are the *Triglochin maritimum* soc. and the *Salicornia europaea*−*Spergularia marina* var. *asiatica* soc. The former is characterized by numerous dark green colored tussocks submerged at high tide. The latter is characterized by an autumn aspect with a series of scarlet carpets. A special colony is found on the *Zostera* wracks, on which

Table 8. Species composition on "Wracks" in shingle salt marsh vegetation

Quadrat (1×1) m²	37	38	39	40	41	42	C.	C.V.
No. of Species	2	2	2	3	4	9		
Halophytes								
Glaux maritima var. *obtusifolia*	3	+	3	+	1	+	V	1338
Potentilla egedei var. *groenlandica*	+	5	·	3	3	+	V	2712
Stellaria humifusa	·	·	·	1	+	+	II	87
Triglochin maritimum	·	·	+	·	+	+	II	5
Salicornia europaea	·	·	·	·	·	+	I	2
Puccinellia kurilensis	·	·	·	·	·	+	I	2
Spergularia marina asiatica	·	·	·	·	·	+	I	2
Nitrophilous plants								
Polygonum tatewakianum	·	·	·	·	·	+	I	2
Atriplex gmelinii	·	·	·	·	·	3	I	625

*Atriplex gmelinii**, *Glaux maritima* var. *obtusifolia*, *Polygonum tatewakianum** and *Potentilla egedei* var. *groenlandica* are common. It seems to be a fragment of a nitrophilous plant (*sign) community rather than that of a salt marsh community, but its appearance is not separable from presence of "*Zostera*" wracks (tab. 8). An excellent physiognomy of shingle salt marsh vegetation is found on Onnikuri, where the *Triglochin* aspect is particularly conspicuous.

In the floristic composition of the present communities the dominant species are *Z. marina*, *T. maritimum*, *P. kurilensis*, *C. subspathacea* and *J. gracillimus*. In stands with a high degree of salinity the constant species is *Salicornia europaea*, While in stands with a moderate degree of salinity the constant species are *Spergularia marina* var. *asiatica*, *Stellaria humifusa*, *Potentilla egedei* var. *groenlandica* and *Glaux maritima* var. *obtusifolia*. Companions are *Polygonum tatewakianum*, *Atriplex gmelinii*, *Phragmites communis* and *Juncus haenkei*.

According to Miyawaki and Ohba (1965), five associations and one community were named; (1) the Zosteretum marinae, (2) the Salicornietum brachystachyae, (3) the Puccinellietum kurilensis, (4) the Juncetum gracillimi, (5) the Caricetum subspathaceae, and the *Triglochin maritimum* community.

V. Bogs with *Sphagna*

The present vegetation is observed in wet places of dune ridges running

parallel from Ryuzinzaki to Nakashibetsu. This contains some *Sphagnum* species but is not of a typical Moss vegetation. Five communites are arranged (tab. 9). They are the *Carex limosa–Sphagnum apiculatum* community, the *Vaccinium oxycoccus–Sphagnum magellanicum* com., the disturbed *V. oxycoccus–Sph. magellanicum* com., the *Carex koidzumii* com. and the *Calamagrostis langsdorffii–Spahgnum* com.

The *Carex limosa–Sphagnum apiculatum* community is different from the Caricetum limosae boreale Ito & Umezawa (1970 and 1973) by having such plants of a Fen type as *Sphagnum palustre, Calamagrostis langsdorffii, Cal. neglecta, Carex vesicaria* etc. The present community is established in depressed habitats, but is rahter rare in Notsukezaki.

The *V. oxycoccus–Sph. magellanicum* community is established on elevated habitats or hummocks which are about 20 cm in height. This community represents a feature of the Sphagnetum papillosi Ito & Umezawa (1970 and 1973) in which *Eriophorum vaginatum* plays a role as the character species and *V. oxycoccus* is prevailing.

The *Carex koidzumii* community is established in the transitional habitats between the *V. oxycoccus–Sph. apiculatum* com. of a Moss type and the *Cal. langsdorfii–Sphagnum* com. of a Fen type. This community is found in some bogs in Hokkaido, e. g. in Sarobetsu (Ito & Tachibana, unpublished), in Yufutsu (Ito & Tachibana, unpublished), and in Kushiro (Tanaka 1977). A syntaxonomical position of this community has not been known exactly by us, but the author will discuss this community in Hokkaido in the later paper.

This *Carex koidzumii* community includes some species common to the preceding community; *Eleocharis kamtschatica, E. wichurae, Juncus krameri, Lastrea thelypteris, V. oxycoccus* etc. *Sphagnum* spcies, *Carex limosa, Eriophorum vaginatum* and *Moliniopsis japonica* which are characteristic of a Moss vegetation disappear in this community.

The *Calamagrostis langsdorffii–Sphagnum palustre* community is a Fen type community and is established in the driest habitat among those communities in this bog vegetation. In this community the highest herb layer is represented by *Calamagrostis langsdorffii* and/or *Cal. neglecta* var. *aculeolata.* The medium herb layer is mainly represented by *Lastrea thelypteris* and also by *Agrostis scabra* and *Carex omiana.* The lowest moss layer is occupied by *Sphagnum palustre* in place of *Sph. magellanicum* and *Sph. papillosum.* Thus, the community physiognomy is shown by very conspicuous three layers which are represented by a combination of dominant species in each layer; *Calamagrostis langsdorffii* in the first layer, *Lastrea thelypteris* in the second layer and *Sphagnum palustre* in the third layer.

Table 9. Bog vegetation with Sphagna in Notsukezaki

Community type	I	II		III		IV		V		
Quadrat	7110	7108	7109	7104	7106	7112	7114	7107	P.	C.V.
Area (m²)	3	1	1	25	25	25	25	25		
No. of Species	12	16	13	18	19	28	34	31		
Max. height of community (cm)	70	15	20	70	40	50	65	—		
Moss elements	.	.	.	.	.	.	.	.		
Carex limosa	4	1	2	.	.	.	.	.	II	1063
C. omiana	2	1	.	1	1	2	2	.	IV	844
Vaccinium oxycoccus	.	3	4	1	1	.	+	3	IV	1845
Drosera rotundifolia	.	1	.	.	1	2	+	1	III	408
Moliniopsis japonica	.	1	1	.	.	.	.	.	II	125
Eriophorum vaginatum	.	1	2	.	.	.	.	.	II	281
Sphagnum apiculatum	3	.	.	.	.	.	.	.	I	469
Sph. magellanicum	.	4	3	.	.	.	.	3	II	1719
Sph. papillosum	.	3	3	.	.	.	.	3	II	1406
Pleurozium schreberi	1	.	.	.	.	.	.	.	I	63
Sphagnum spp.	.	.	.	3	.	.	.	.	II	469
Fen/marsh elements										
Calamagrostis langsdorffii	.	+	.	2	+	2	3	2	IV	1128
Lastrea thelypteris	.	+	1	+	.	1	4	4	IV	1690
Sph. palustre	2	1	.	.	.	3	3	.	II	1219
Ledum palustre	.	.	1	2	.	.	.	.	II	281
Triadenum japonicum	2	.	.	+	+	.	.	.	II	221
Lobelia sessilifolia	+	.	.	+	1	.	.	.	II	65
Lysimachia thrysiflora	.	.	.	+	.	.	+	.	II	3
Carex koidzumii	1	.	.	4	3	.	.	.	II	1313
C. vesicaria	+	.	.	2	.	.	.	.	II	220
Galium trifidum var. *brevipedunculatum*	.	.	.	.	+	.	+	.	II	3
Phragmites communiis	+	.	.	.	.	.	3	.	II	470
Lycopus maackianus	.	.	.	.	1	1	.	+	II	126
L. uniflorus	.	.	+	.	.	.	+	.	II	3
L. lucidus	.	.	.	.	.	.	+	.	I	1
Sanguisorba tenuifolia var. *alba*	.	.	+	.	.	1	1	1	III	189
Iris ensata var. *spontanea*	.	.	.	.	.	3	.	1	II	531
Potentilla palustris	.	.	.	.	4	.	.	.	I	781
Triglochin palustre	.	.	.	.	+	.	.	.	I	1
Eleocharis kamtschatica	.	1	.	.	2	.	.	1	II	344
E. wichurae	.	1	.	.	1	.	2	.	III	344
Carex krameri	.	.	.	.	+	.	.	.	I	1
Viola langsdorffii	.	.	.	.	.	1	1	+	II	126
Rubia jessoensis	.	.	.	.	.	r	+	1	II	64
Trientalis europaea	.	.	+	.	.	+	+	+	III	5
Stachys japonica var. *intermedia*	.	.	.	.	.	.	.	+	I	1
Hosta rectifolia	.	+	+	.	.	+	1	.	III	66
Eriophorum gracile	.	.	.	.	.	.	2	.	I	219
Lathyrus palustris var. *pillosus*	.	.	.	.	.	.	2	.	I	219
Epilobium palustre	.	.	.	.	.	.	1	.	I	63
Lysichiton kamtschatcense	.	.	.	.	.	.	+	.	I	1
Polytrichum sp.	.	.	.	1	.	1	.	1	II	188
Others										
Juncus effusus	.	+	+	1	2	1	2	1	IV	628
J. gracilimus	.	.	.	1	.	1	.	.	II	125
J. krameri	1	+	.	+	1	1	.	2	IV	409
J. prominens	.	.	.	1	.	.	.	.	I	63
Agrostis scabra	.	.	.	.	+	2	3	2	III	908
Festuca rubra var. *rubra*	.	.	.	.	.	1	1	1	II	188
Maianthemum dilatatum	.	.	.	.	.	3	1	2	II	750
Solidago virga-aurea var. *leiocarpa*	.	.	.	.	.	1	+	.	II	64
Spiranthes sinensis	.	.	.	.	r	.	.	.	I	—
Thermopsis lupinoides	.	.	.	.	.	.	.	2	I	219
Ixeris dentata var. *albiflora*	.	.	.	.	.	.	.	1	I	63
Miscanthus sinensis	.	.	.	.	.	.	.	+	I	1
Geranium yezoense	.	.	.	.	.	+	.	1	II	64
Viola acuminata	.	.	.	.	.	.	.	1	I	63
Ranunculus grandis var. *austrokurilensis*	.	.	.	.	.	+	1	+	II	65
Hypericum erectum	.	.	.	.	.	+	.	+	II	3
Prunella vulgaris	.	.	.	.	.	1	.	+	II	64
Carex stipata	.	.	.	.	.	.	2	.	I	219
C. arenicola	.	.	.	.	.	1	2	.	II	281
C. gmelinii	.	.	.	.	.	1	.	.	I	63
C. subspathacea	.	.	.	.	.	1	.	.	I	63
Cicuta virosa	.	.	.	.	.	.	+	.	I	1
Osmundastram asiaticum var. *foekiense*	.	.	.	.	.	.	+	.	I	1
Poa macrocalyx var. *scabriflora*	.	.	.	.	.	.	1	.	I	63
Platanthera sachalinensis	.	.	.	.	.	.	+	.	I	1
Hemerocallis middendorffii	.	.	.	.	.	.	1	.	I	63
Carex sp.	.	.	.	.	.	.	.	3	I	469
Calamagrostis neglecta	1	.	.	2	+	2	.	2	III	720
Onoclea sensibilis var. *interrupta*	.	.	.	1	.	.	.	.	I	63
Trifolium repens	.	.	.	.	.	.	.	1	I	63

I: The *Carex limosa—Sphagnum apiculatum* community
II: The *Vaccinium oxycoccus—Sphagnum magellanicum* community
III: The *Carex koidzumii* community
IV: The *Calamagrostis langsdorffii—Lastrea therypteris—Sphagnum palustre* community
V: The disturbed *Vaccinium oxycoccus—Sphagnum magellanicum* community

VI. Slack vegetation

Slacks develop between dune ridges of the beach in apposition to Ryuzinzaki to Nakashibetsu and form permanent pools. Four hydrophytic communities are recognizable. They are the *Alisma plantago-aquatica* var. *orientale–Hippuris vulgaris* community, the *Schoenoplectus tabernaemontanii* com., the *Eleocharis mamillata* var. *cyclocarpa–Eleoch. kamtschatica* com. and the *Carex* com. Occurrence of these communities is to some extent governed by water depth. The first community is usually found in the deepest pool, and the fourth community is found in the shallowest one. The *Schoenoplectus*– and the *Eleocharis*–community are found in the intermediate pools between the extremes in depth. In the slack vegetation in this area, pools lack *Nuphar* and *Nymphaea* species which are common aquatic members in Hokkaido. A typical physiognomy develops near Ryuzinzaki.

In the floristic composition of the present vegetation, the leading species are as follows: *Alisma plantago-aquatica* var. *orientale, Eleocharis kamtschatica, Eleoch. mamillata* var. *cyclocarpa, Carex vesicaria* and *Schoenoplectus tabernaemontanii.* The constant species are *Carex koidzumii, Hippuris vulgaris, Juncus prominens* and *Ranunculus reptans.* Companions are *Calamagrostis langsdorfii, Cal. neglecta* var. *aculeolata, Carex arenaria, C. omiana, C. stipata, Eriocaulon kushiroense, ? Glyceria natans, Iris ensata* var. *spontanea, I. setosa, Lycopus maackianus, Phragmites communis, Sparganium glomeratum* and *Triadenum japonicum.* Among them, *Ranunculus reptans* is a rare plant in Japan, and its habitats in Hokkaido have been reported from only two localities; Notsukezaki and Mamisunuma-pond of Mt. Soranuma (Ito 1960). This species is commonly found on the tussocks of sedges and in shallow pools with *Polygonum thunbergii* in Notsukezaki.

VII. Forest vegetation

Phytosociological data of forest communities of Notsukezaki have been published by the present author in 1970. As a result, sixteen forest communities were described in the preceding paper (Ito 1970). These communities are as follows:

A. Broad-leaved, Summer–green forest communities

1. *Betula ermanii–Rhus ambigua* community, 2. *B. ermanii–Acer mono–R. ambigua* com., 3. *B. ermanii–Sorbus commixta–Dryopteris austriaca* com., 4. *B. ermanii–Picea jezoensis–R. ambigua* com., 5. *Fraxinus mandshurica* var. *japonica–Alnus japonica* · *F. mandshurica* var. *japonica* · *A. japonica–Polygonum thunbergii* com., 6. *F. mandshurica* var. *japonica–Matteuccia struthiopteris* com., 7. *A. japonica–Carex vesicaria* com., 8. *Quer-*

Table 10. Slack vegetation in Notsukezaki

Quadrat	7101	7102	7121	7122	6398	63986	63982	P.	C.V.
Area (m^2)	10	10	1	1	25	1	25		
No. of Species	9	8	10	10	8	7	13		
Max. community height(cm)	80	80	70	70	—	—	—		
Water depth (cm)	—	—	—	—	—	10 ~ 15	—		
Life form: Hyd									
Alisma plantago-aquatica var. *orientale*	+	3	·	·	2	1	+	Ⅳ	860
Sparganium glomeratum	1	1	·	·	1	·	·	Ⅲ	214
Hippuris vulgaris	+	1	·	·	1	·	·	Ⅲ	144
Utricularia intermedia	·	·	·	·	+	·	+	Ⅱ	3
Life form: Hel									
Eleocharis mamillata var. *cyclocarpa*	5	4	3	·	·	·	·	Ⅲ	2679
E. kamtschatica	·	·	4	4	+	·	·	Ⅲ	1787
E. wichurae	·	·	2	1	·	·	·	Ⅱ	321
E. acicularis var. *thermalis*	·	·	·	·	·	4	·	Ⅰ	893
Eriocaulon kushiroense	3	2	·	·	·	+	·	Ⅲ	787
Carex vesicaria	1	·	+	1	·	1	4	Ⅳ	1109
Schoenoplectus tabermaemontanii	·	1	·	·	2	·	·	Ⅱ	321
?Glycerta natans	·	1	·	·	·	·	·	Ⅰ	71
Potentilla palustris	·	·	+	·	·	·	+	Ⅱ	3
Carex limosa	·	·	·	1	·	·	·	Ⅰ	71
Lythrum salicaria	·	·	·	·	+	·	·	Ⅰ	1
Phragmites communis	·	·	·	·	·	+	·	Ⅰ	1
Carex stipalata	·	·	·	·	·	·	3	Ⅰ	536
Life form: H									
Ranunculus reptans	+	·	1	1	·	·	·	Ⅲ	144
Triadenum japonicum	·	·	2	1	·	·	+	Ⅲ	322
**Juncus prominens*	·	·	·	+	·	·	·	Ⅰ	1
**J. effusus*	·	·	·	·	1	·	1	Ⅱ	143
**Polygonum thunbergii*	·	·	·	·	·	·	1	Ⅱ	71
**Rumex crispus*	·	·	·	·	·	·	+	Ⅰ	1
***Agrostis scabra*	·	·	1	1	·	·	·	Ⅱ	143
***Calamagrostis langsdorffii*	·	·	·	·	·	·	+	Ⅰ	1
**Puccinellia kuria kurilensis*	1	·	·	·	·	·	·	Ⅰ	71
Life form: Grh									
Juncus krameri	2	1	2	3	·	·	·	Ⅲ	1107
J. haenkei	·	·	·	·	·	1	·	Ⅰ	71
Lycopus maackianus	·	·	1	+	·	+	+	Ⅲ	76
Lastrea thelypteris	·	·	·	·	·	·	+	Ⅰ	1
Life form: Th									
Polygonum hydropiper	·	·	·	·	·	·	1	Ⅰ	71

* Hs ** Hp

cus crispula–R. ambigua com., 9. *Q. crispula–Fragaria yezoensis* com., and 10. *Acer mono–Sasa amphitricha* com.

B. Mixed forest communities*

11. *Abies sachalinensis*・*B. ermanii*・*Q. crispula–Ab. sachalinensis–Ab. sachaliensis* com., 12. *Picea jezoensis–Q. crispula–R. ambigua* com., 13. *B. ermanii*・*Q. crispula*・*(Ab. sachalinensis)–Ab. sachalinensis–R. ambigua*・*Maianthemum dilatatum* com., and 14. *B. ermanii*・*P. jezoensis–P. jezoensis–M. dilatatum* com.

C. Boreal coniferous forest communities

15. *Ab. sachalinensis–Ab. sachalinensis–Ab. sachalinensis* com., and 16. *P. jezoensis–D. austriaca* com.

Forest vegetation of Notsukezaki is summarized as follows; 1) in the uppermost layer (over 15 m in height), *Abies sachalinensis*, *Picea jezoensis*, *Betula ermanii*, and *Fraxinus mandshurica* var. *japonica* are commonly

Table 11. Number of tree plants in height classes in the community shown by fig. 5

Height (m) / Species	1 ≀ 2	2 ≀ 4	4 ≀ 6	6 ≀ 8	8 ≀ 10	10 ≀ 12	12 ≀ 14	Total
Betula ermanii (Be)	0	1	0	0	1	2	2	6
Quercus crispula	11	10 (1)	7 (1)	4	11	2	0	45 (2)
Acer mono (Am)	0	1	0	0	0	1	0	2
Hydrangea paniculata (H)	0	1	1	0	0	0	0	2
Total	11	13 (1)	8 (1)	4	12	5	2	55 (2)

Table 12. Number of tree plants in DBH classes in the community shown by fig. 5

DBH (cm) / Species	2 ≀ 4	4 ≀ 6	6 ≀ 8	8 ≀ 10	12 ≀ 14	14 ≀ 16	16 ≀ 18	18 ≀ 20	20 ≀ 22	22 ≀ 24	24 ≀ 26	26 ≀ 28	28 ≀ 40	Total
Betula ermanii	1	0	0	0	0	0	4	0	1	0	0	0	0	6
Quercus crispula	11	4	2	1	1	3	3	6	5	4 (1)	3	1	1	45 (1)
Acer mono	1	0	0	0	0	0	0	0	1	0	0	0	0	2
Hydrangea paniculata	0	1	1	0	0	0	0	0	0	0	0	0	0	2
Total	13	5	3	1	1	3	7	6	7	4 (1)	3	1	1	55 (1)

* "Mixed" means a mixture of broad-leaved, summer-green trees with evergreen conifers in the uppermost layer.

found as the dominant; 2) under the high-tree communities, the lower mesophanerophyte layer (8–15 m in hieight) is poorly developed, but at times *Abies sachalinensis*, *Betula ermanii*, *Sorbus commixta*, and *Acer mono* are the dominant tree plants of the low-tree communities respectively; 3) development of the microphanerophyte layer (2–8 m in height) is conspicuous; and 4) the dominant species of the herb layer (less 2 m in height) are *Dryopteris austriaca*, saplings of *Abies sachalinensis*, *Rhus*

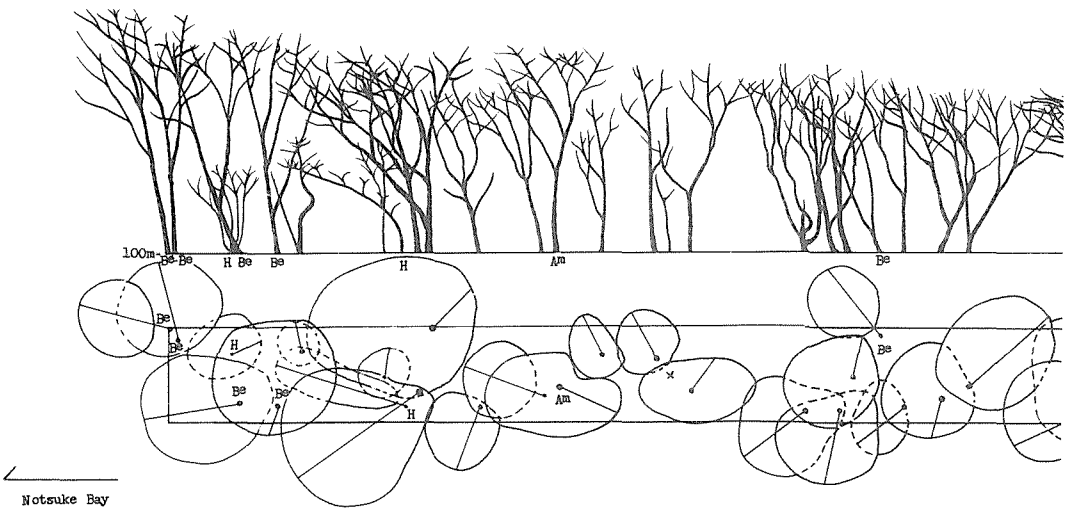


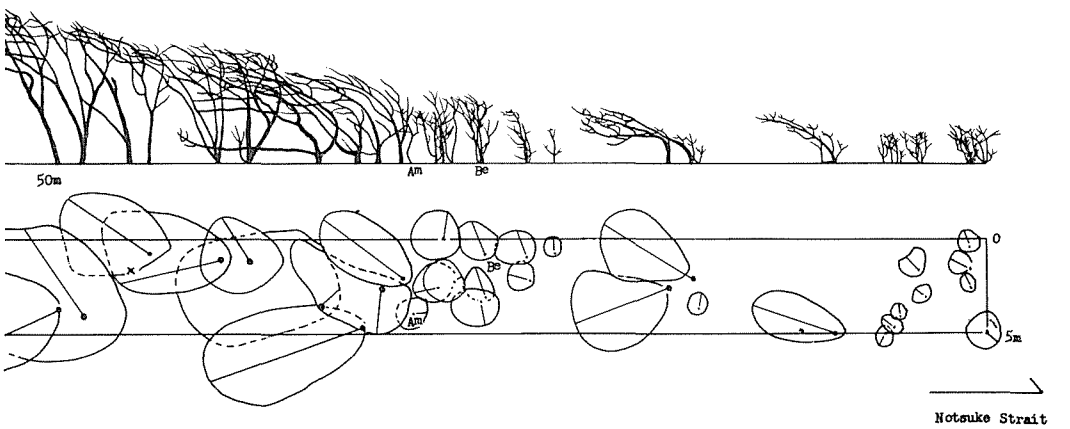
Fig. 5. The *Quercus crispla-Rhus ambigna* community

Table 13. Species composition of the community shown by fig. 5

Distance (m) / Species	0–5	5–10	10–15	15–20	20–25	25–30	30–35	35–40	40–45	45–50	50–55	55–60	60–65	65–70	70–75	75–80	80–85	85–90	90–95	95–100	Freq.	C.V.
Acer mono	·	·	+	+	·	·	·	+	+	+	+	+	+	+	+	+	+	·	+		IV	
Kalopanax pictus	·	·	·	·	·	·	·	·	·	+	·	+	·	·	·	+	+	1	+		II	25
Rubus idaeus var. *aculeatissimus*	1	1	1	1	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·		II	100
Rosa rugosa	·	+	2	3	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·		II	
Rhus ambigna	·	·	·	+	·	·	+	+	3	4	1	5	2	4	5	3	4	5	5	4	IV	3488
Schisandra chinensis	·	·	·	·	+	+	+	+	·	·	·	+	+	+	+	+	+	+	1	+	IV	25
Celastrus orbiculatus var. *papillosus*	+	+	+	·	+	+	·	+	·	·	+	·	+	+	·	·	+	·	+	·	III	
Sasa amphitricha	4	4	4	3	1	1	1	+	1	1	+	1	+	1	1	+	+	+	+	1	V	1160
Fragaria yezoensis	+	1	+	·	+	+	+	1	1	2	3	1	3	3	+	1	+	+	·	2	V	804
Geranium erianthum	+	+	+	+	+	+	+	+	1	+	+	+	+	+	+	+	+	+	+	+	V	25
Maianthemum dilatatum	+	·	·	·	·	+	+	+	·	+	·	+	+	+	+	+	+	+	+	+	IV	

ambigua, and *Maianthemum dilatatum*. From remnants found in the herb layer of those communities, it is generally assumed that in the original herb layer of the summer-green forest communities *Sasa amphitricha* was dominant, and that in that of the coniferous forest communities oligotrophic and/or acidiphious plants such as *Cornus suecica*, *Pyrola renifolia*, *Pyrola secunda*, and *Vaccinium praestans* were frequently abundant.

Six representative forest communities will be shown in figures 5–10, and tables 11 – 28 in the present paper.



Distance (m) / Species	0–5	5–10	10–15	15–20	20–25	25–30	30–35	35–40	40–45	45–50	50–55	55–60	60–65	65–70	70–75	75–80	80–85	85–90	90–95	95–100	Freq.	C.V.
Brachypodium sylvaticum	·	·	·	·	·	·	·	1	·	·	+	·	+	·	·	+	+	+	+	+	II	25
Geum aleppicum	+	1	·	+	+	·	·	+	·	·	+	+	·	·	·	·	·	·	+	·	+	III	
Artemisia montana	·	+	+	+	+	+	·	+	·	·	·	·	·	·	·	·	·	·	·	·	·	II	
Platanthera sachalinensis	·	·	·	·	·	·	·	·	+	+	+	·	·	+	+	·	·	·	+	·	II		
Pteridium aquilinum var. *latiusculum*	5	4	1	1	1	+	4	4	4	1	1	+	+	+	+	+	+	+	1	+	V	1838	
Festuca rubra var. *rubra*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	V		
Thermopsis lupinoides	1	1	+	1	2	4	2	+	1	1	+	1	·	+	+	+	+	+	+	·	IV	604	
Geranium yesoense	+	+	+	1	+	+	·	·	1	·	·	·	·	+	·	+	+	·	·	·	III	50	
Moehringia lateriflora	·	·	·	·	+	+	+	·	·	+	+	·	·	·	·	+	·	·	·	+	III		
Thalictrum aquilegifolium	·	·	·	·	+	+	+	·	·	+	·	·	·	+	·	+	+	·	+	+	III		
Vicia cracca	+	·	+	·	·	·	·	·	·	·	+	+	·	·	+	·	+	·	·	+	III		
Anaphalis margaritacea var. *angustior*	·	+	+	·	+	+	+	+	+	·	·	·	·	·	·	·	·	·	·	·	II		
Ranunculus franchetii	·	·	·	·	+	·	·	·	·	+	+	·	+	·	+	+	·	·	·	·	II		
Solidago virga-aurea var. *leiocarpa*	·	·	·	·	·	·	+	·	+	·	·	·	+	+	·	·	·	+	+	·	II		

Distance (m) / Species	0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 ≀ 5 10 15 20 25 30 35 40 45 50 55 60 56 70 75 80 85 90 95 100	Freq.	C.V.
Calamagrostis langsdorffii	· · · · + + + + · + · + + + + · · · + ·	III	
Sanguisorba tenuifolia var. *alba*	· · · + · · · · + + · · + · · · · + · ·	II	
Agrimonia pilosa var. *japonica*	1 1 2 + 3 1 1 + · · · + + + + + + · + +	III	375

Frequency I: *Botrychium robustum, Dryopteris austriaca, Athyrium filix-femina* var. *longipes*; *Betula ermanii, Quercus crispula, Geum japonicum Prunus sargentii, Sorbus commixta*: *Vitis coignetiae*; *Sanicula chinensis, Torilis japonica, Viola langsdorffii, Viola acuminata, Pyrola secunda, Trientalis europaea, Scutellaria pekinensis* var. *ussuriensis, Cirsium kamtschaticum, Milium effusum*; *Hydrangea paniculata, Trifolium repens, Cicuta virosa, Angelica anomala, Halenia corniculata, Galium verum* var. *trachycarpum, Achillea sibirica, Petasites japonicus* var. *giganteus, Agrostis scabra, Agrostis clavata* var. *nukabo, Poa pratensis, Miscanthus sinensis, Juncus tenuis*; *Plantago asiatica*. Total species number 60, Species occurrence point number 336 and occurrence point number per a species 336/60=0.6

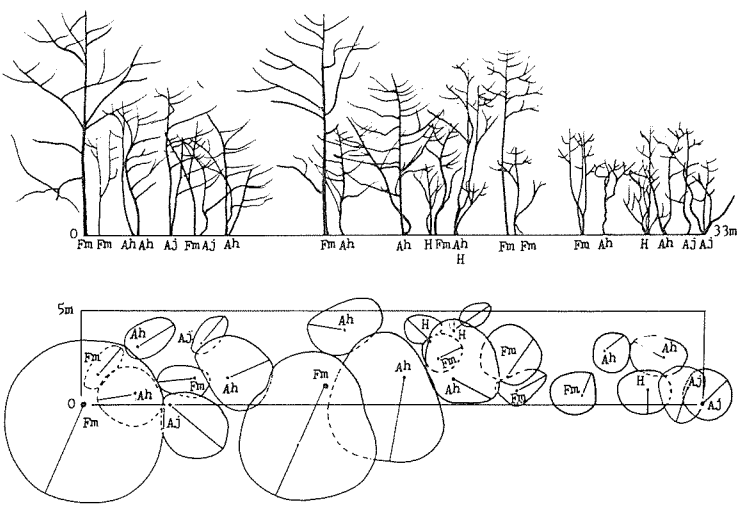


Fig. 6. The *Fraxinus mandshurica* var *japonica*・*Alnus japonica* var. *arguta*・*Alnus hirsuta* community

Table 14. Number of tree plants in height classes in the community shown by fig. 6

Height (m) / Species	3 ≀ 4	4 ≀ 5	5 ≀ 6	6 ≀ 7	7 ≀ 8	8 ≀ 9	9 ≀ 10	10 ≀ 11	12 ≀ 13	Total
Fraxinus madshurica var. *j.* (Fm)	0	0	1	3	1	0	0	1	2	8
Alnus hirsuta (Ah)	0	1	1	2	2	0	2	0	0	8
Alnus japoniica var. *arguta* (Aj)	0	1	1	1	0	1	0	0	0	4
Hydrangea paniculata (H)	1	2	0	0	0	0	0	0	0	3
Total	1	4	3	6	3	1	2	1	2	23

Table 15. Number of tree plants in DBH classes in the community shown by fig. 6

DBH (cm) / Species	3 ≀ 4	5 ≀ 6	6 ≀ 7	7 ≀ 8	8 ≀ 9	9 ≀ 10	11 ≀ 12	12 ≀ 13	15 ≀ 16	17 ≀ 18	18 ≀ 19	20 ≀ 21	22 ≀ 23	26 ≀ 27	Total
Fraxinus mandshurica var. *j.*	0	1	1	0	1	1	1	0	0	0	1	0	1	1	8
Alnus hirsuta	0	0	0	0	1	2	1	1	0	1	0	1	1	0	8
Alnus japonica var. *arguta*	1	0	1	1	0	0	0	0	1	0	0	0	0	0	4
Hydrangea paniculata	0	0	1	1	0	0	1	0	0	0	0	0	0	0	3
Total	1	1	3	2	2	3	3	1	1	1	1	1	2	1	23

Table 16. Species composition of the community shown by fig. 6

Distance (m) / Species	0 ≀ 5	5 ≀ 10	10 ≀ 15	15 ≀ 20	20 ≀ 25	25 ≀ 30	Freq.	C.V.
Rhus ambigua	·	+	·	+	+	·	III	
Polygonum thunbergii	4	4	5	5	3	1	V	5708
Carex vesicaria	+	+	·	+	2	3	V	917
Lysichiton camtschatcense	·	1	1	+	1	1	V	333
Lycopus maackianus	+	+	+	+	+	+	V	
Hosta rectifoilia	+	·	·	+	+	+	IV	
Viola verecunda var. *semilunaris*	·	+	+	+	·	+	IV	
Cicuta virosa	+	+	·	+	·	·	III	
Stellaria longifolia	+	·	+	·	·	·	II	
Phragmites communis	·	+	+	·	·	·	II	
Lobelia sessilifolia	·	·	·	·	+	+	II	
Calamagrostis langsdorffii	1	+	1	+	2	2	V	750
Osmundastrum cinnamomeum var. *fokiense*	2	1	·	·	·	2	III	667
Juncus effusus	·	·	1	+	+	+	IV	83
Agrostis scabra	+	·	+	·	+	·	III	
Stellaria fenzlii	·	·	+	·	+	·	II	
Sanguisorba tenuifolia var. *alba*	·	·	·	·	+	+	II	
Maianthemum dilatatum	·	+	+	+	·	·	III	
Juncus krameri	+	·	+	+	+	·	IV	
Plantago asiatica	·	·	+	+	·	·	II	
Scutellaria ussuriensis var. *yezoensis*	+	·	+	·	·	·	II	

Frequency I: *Stachys japonica* var. *villosa*, *Galium trifidum* var. *brevipedunculatum*, *Calamagrostis epigeios*, *Eleocharis kamtschatica*; *Lastrea thelypteris*, *Thalictrum minus* var. *hypoleucum*, *Festuca rubra* var. *rubra*; *Athyrium filix-femina* var. *longipes*, *Geum aleppicum*, *Milium effusum*; *Agrimonia pilosa* var. *japonica*, *Agrostis alba*. Total species number 33, Species occurrence point number 85 and occurrence point number per a species 85/33=2.6

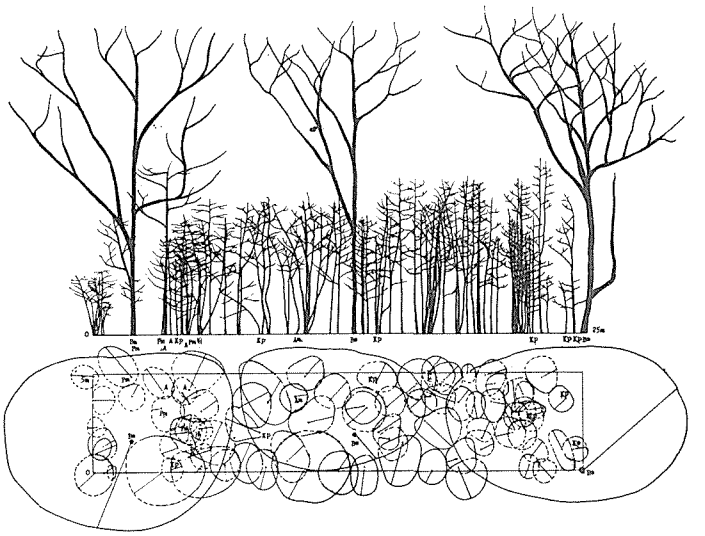


Fig. 7. The *Betula ermanii-Sorbus commixta-Dryopteris austriaca* community

Table 17. Number of tree plants in height classes in the community shown by fig. 7

Height (m) / Species	1 ≀ 2	2 ≀ 3	3 ≀ 4	4 ≀ 5	5 ≀ 6	6 ≀ 7	7 ≀ 8	8 ≀ 9	15 ≀ 16	16 ≀ 17	Total
Betula ermanii (Be)	0	0	0	0	0	0	0	0	2	1	3
Sorbus commixta	2	7	2	12	12	17	12	1	0	0	65
Prunus maximowiczii (Pm)	0	0	0	1	2	0	0	0	0	0	3
Kalopanax pictus (Kp)	0	4	0	1	1	0	0	0	0	0	6
Abies sachalinensis (A)	0	0	1	1	0	0	0	0	0	0	2
Acer mono (Am)	0	0	1	0	0	0	0	0	0	0	1
Hydrangea paniculata (H)	0	0	1	0	0	0	0	0	0	0	1
Total	2	11	5	15	15	17	12	1	2	1	81

Table 18. Numder of tree plants in DBH classes in the community shown by fig. 7

DBH (cm) / Species	0 ≀ 2	2 ≀ 4	4 ≀ 6	6 ≀ 8	8 ≀ 10	36 ≀ 38	44 ≀ 46	Total
Betula ermanii	0	0	0	0	0	2	1	3
Sorbus commixta	11	29	17	7	1	0	0	65
Prunus maximowiczii	0	1	0	1	1	0	0	3
Kalopanax pictus	3	3	0	0	0	0	0	6
Abies sachalinensis	0	2	0	0	0	0	0	2
Acer mono	0	1	0	0	0	0	0	1
Hydrangea paniculata	1	0	0	0	0	0	0	1
Total	15	36	17	8	2	2	1	81

Table 19. Species composition of the community shown by fig. 7

Distance (m) / Species	0 ≀ 5	5 ≀ 10	10 ≀ 15	15 ≀ 20	20 ≀ 25	Freq.	C.V.
Abies sachalinensis	+	+	·	·	+	III	
Euonymus oxyphyllus	+	·	·	+	·	II	
Rhus ambiga	+	2	1	+	+	V	450
Dryopteris austriaca	4	2	3	5	4	V	5350
Maianthemum dilatatum	1	1	·	+	+	IV	
Solidago virga-aurea var. *leiocarpa*	+	·	+	+	+	IV	
Calamagrostis langsdorffii	+	+	+	+	·	IV	
Osmundastrum cinnamomemum var. *fokiense*	+	+	·	·	+	III	
Lysichiton camtschatcense	·	·	+	·	+	II	
Juncus effusus	·	·	+	·	+	II	
Cirsium kamtschaticum	·	·	+	·	+	II	

Frequency I: *Betula ermanii, Prunus maximowiczii, Acer mono, Kalopanax pictus; Cacalia auriculata* var. *kamtschatica*; *Trientalis europaea* var. *europaea, Aster glehnii*; *Carex vesicaria, Lycopus maackianus, Polygonum thunbergii.* Total speices number 21, Species occurrence point number 46 and occurrence point number per a species 46/21=2.2

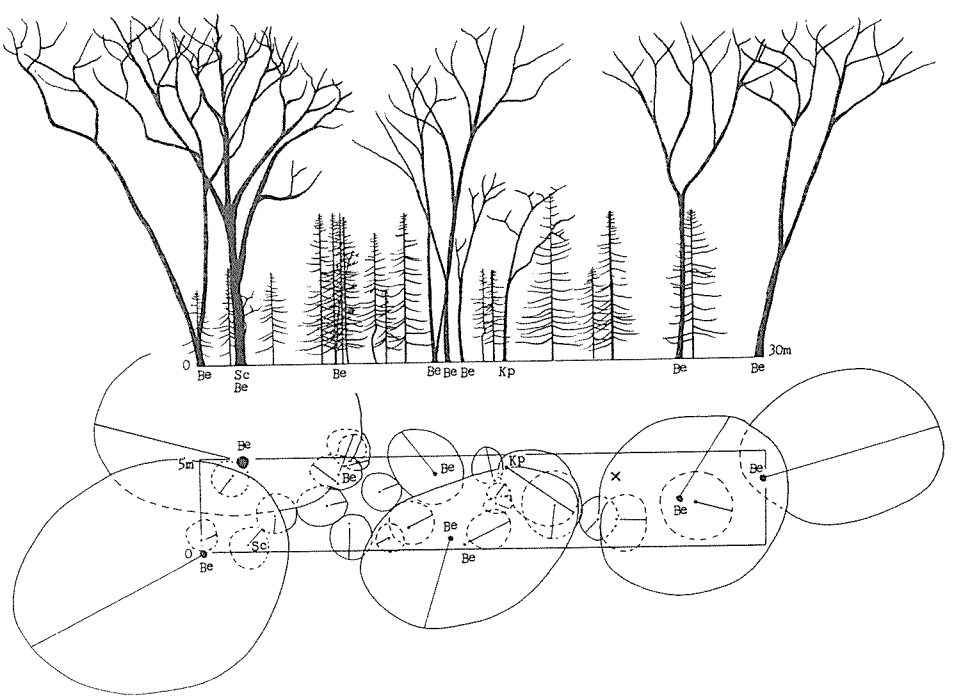


Fig. 8. The *Betula ermanii-Picea jezoensis-Rhus ambigua* community

Table 20. Number of tree plants in height classes in the community shown by fig. 8

Height (m) / Species	2 ≀ 4	4 ≀ 6	6 ≀ 8	8 ≀ 10	14 ≀ 16	16 ≀ 18	Total
Betula ermanii (Be)	0	1	0	1	1	5	8
Picea jezoensis	2	5	10	1	0	0	18
Kalopanax pictus (Kp)	0	0	0	1	0	0	1
Sorbus commixta (Sc)	1	0	0	0	0	0	1
Total	3	6	10	3	1	5	28

Table 21. Number of tree plants in DBH classes in the community shown by fig. 8

DBH (cm) / Species	1 ≀ 2	2 ≀ 4	4 ≀ 6	6 ≀ 8	8 ≀ 10	12 ≀ 14	24 ≀ 26	Total
Betula ermanii	0	1	1	1	2	2	1	8
Picea jezoensis	4	8	6	0	0	0	0	18
Kalopanax pictus	0	1	0	0	0	0	1	1
Sorbus commixta	1	0	0	0	0	0	0	1
Total	5	10	7	1	2	2	1	28

Table 22. Species composition of the community shown by fig. 8

Distance (m) / Species	0 ≀ 5	5 ≀ 10	10 ≀ 15	15 ≀ 20	20 ≀ 25	25 ≀ 30	Freq.	C.V.
Sorbus commixta	1	+	1	+	1	1	V	252
Acer mono	·	·	+	+	+	+	IV	
Kalopanax pictus	·	·	+	·	+	+	III	
Picea jezonsis	+	·	·	·	+	·	II	
Rhus ambigua	5	+	3	3	3	5	V	4792
Sasa amphitricha	+	·	+	+	1	+	IV	83
Dryopteris austriaca	+	+	+	·	+	+	V	
Maianthemum dilatatum	·	+	+	+	+	·	IV	
Pyrola incarnata	·	+	·	·	+	·	II	
Brachypodium sylvaticum	·	·	+	·	+	·	II	
Pteridium aquilinum var. *latiusculum*	+	·	·	+	+	+	IV	
Calamagrostis langsdorffii	+	·	·	·	+	+	III	
Thalictrum minus var. *hypoleucum*	·	·	+	·	+	+	III	
Agrimonia pilosa var. *japonica*	·	·	+	·	·	+	II	

Frequency I: *Euonymus oxyphyllus*; *Celastrus orbiculatus* var. *papillosus*, *Vitis coignetiae* f. *glabrescens*; *Fragaria yezoensis*, *Geum aleppicum*, *Sanicula chinensis*, *Galium trifloriforme*, *Solidago Virga-aurea* var. *leiocarpa*, *Polygonatum odoratum* var. *maximowiczii*, *Platanthera sachalinensis*; *Anthriscus nemorosa*; *Matteuccia struthiopteris*, *Polygonum thunbergii*, *Impatiens noli-tangere*; *Osmundastrum cinnamomeum* var. *fokiense*, *Aruncus dioicus* var. *kamtschaticus*, *Petasites japonicus* var. *giganteus*; *Plantago asiatica*, *Poa pratensis*. Total species number 33, Species occurrence point number 70 and occurrence point number per a species 70/33=2.1

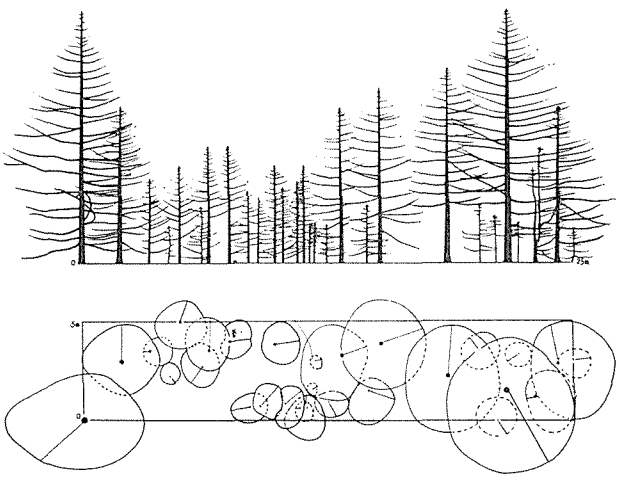


Fig. 9. The *Abies sachalinensis-A. sachalinensis-A. sachalinensis* community

Table 23. Number of tree plants in height classes in the community shown by fig. 9

Height (m) / Species	1 ≀ 2	2 ≀ 4	4 ≀ 6	6 ≀ 8	8 ≀ 10	12 ≀ 14	Total
Abies sachalinensis	23	13	8	3	2	2	51

Table 24. Number of tree plants in DBH classes in the community shown by fig. 9

DBH (cm) / Species	2 ≀ 4	4 ≀ 6	6 ≀ 8	8 ≀ 10	10 ≀ 12	12 ≀ 14	14 ≀ 16	16 ≀ 18	18 ≀ 20	20 ≀ 22	26 ≀ 28	30 ≀ 32	Total
Abies sachalinensis	15	18	4	4	1	1	1	2	2	1	1	1	51

Table 25. Species composition of the community shown by fig. 9

Distance (m) / Species	0 ≀ 5	5 ≀ 10	10 ≀ 15	15 ≀ 20	20 ≀ 25	Freq.	C.V.
Sorbus commixta	+	·	+	·	+	III	

Distance (m) / Species	0 ≀ 5	5 ≀ 10	10 ≀ 15	15 ≀ 20	20 ≀ 25	Freq.	C.V.
Rhus ambigua	1	1	1	1	1	V	400
Sasa amphitiricha	+	·	+	·	·	II	
Dryopteris austriaca	2	·	·	·	+	II	50
Actaea erythrocarpa	+	+	·	·	·	II	
Brachypodim sylvaticum	+	·	+	·	·	II	
Agrimonia pilosa var. *japonica*	+	+	+	·	+	III	

Frequency I: *Abies sachalinensis, Quercus crispula, Prunus sargentii, Acer mono*; *Cacalia auriculata* var. *kamtschatica, Cirsium kamtschatica, Milium effusum, Polygonatum odoratum* var. *maximowiczii*; *Geum aleppicum, Anthriscus nemorosa, Sanicula chinensis*; *Solidago virgaaurea* var. *leiocarpa, Agrostis scabra, Poa pratensis.* Total species number 21, Species occurrence point number 33 and occurrence point nuber per a species 33/21=1.6

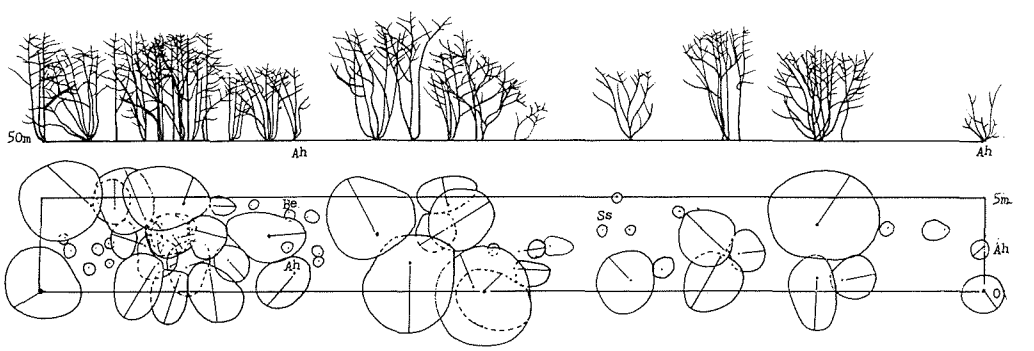


Fig. 10. The *Alnus japonica* var. *arguta-Carex vesicaria* community
Be: *Betala ermanii*, Ss: *Salix sachalinensis*

Table 26. Number of tree plants in height classes in the community shown by fig. 10

Height (m) / Species	0 ≀ 1	1 ≀ 2	2 ≀ 3	3 ≀ 4	4 ≀ 5	5 ≀ 6	6 ≀ 7	Total
Alnus japonica var. *arguta*	17	4	3	3	12	15	2	56
Alnus hirsuta (Ah)	1	0	0	1	0	0	0	2
Total	18	4	3	4	12	15	2	58

Table 27. Number of tree plants in DBH classes in the community shown by fig. 10

DBH (cm) / Species	2 ≀ 4	4 ≀ 6	6 ≀ 8	8 ≀ 10	10 ≀ 12	12 ≀ 24	Total
Alnus japonica var. *arguta*	5	11	11	6	1	1	35
Alnus hirsuta	0	0	1	0	0	0	1
Total	5	11	12	6	1	1	36

Table 28. Species composition of the community shown by fig. 10

Distance (m) / Species	0 ≀ 5	5 ≀ 10	10 ≀ 15	15 ≀ 20	20 ≀ 25	25 ≀ 30	30 ≀ 35	35 ≀ 40	40 ≀ 45	45 ≀ 50	Freq.	C.V.
Carex vesicaria	5	5	3	5	5	4	4	4	4	3	V	6750
Lobelia sessilifolia	+	+	+	+	+	·	+	+	+	+	V	
Galium trifidum var. *brevipedunculatum*	+	+	+	+	+	+	+	·	+	+	V	
Lycopus maackianus	+	+	+	+	+	+	·	+	+	+	V	
Polygonum thunbergii	·	+	·	·	+	+	+	2	2	3	IV	725
Eleocharis kamtschatica	+	1	1	1	+	1	1	·	1	1	IV	200
Potentilla palustris	+	+	·	·	+	+	·	+	·	·	III	
Phragmites communis	+	+	+	+	·	·	·	·	·	·	II	
Cicuta virosa	·	·	·	·	·	·	·	+	+	+	II	
Calamagrostis langsdorffii	+	1	2	1	+	1	1	1	2	1	V	650
Lastrea thelypteris	+	·	+	+	+	+	+	+	+	·	IV	
Epilobium cephalostigma	·	+	+	+	+	+	+	+	·	+	IV	
Sanguisorba tenuifolia var. *alba*	·	1	+	·	+	·	·	·	·	·	II	50
Agrostis scabra	+	+	1	1	+	+	+	+	+	+	V	100
Festuca rubra var. *rubra*	·	·	+	+	·	·	+	·	·	+	II	
Juncus effusus	+	+	1	+	+	1	1	+	1	+	V	200
Juncus krameri	+	+	+	+	+	+	1	+	+	+	V	50

Frequency I: *Salix sachalinensis, Betula ermanii, Triadenum japonicum, Hypericum ascyron, Lysimachia vuglaris* var. *davurica, Stachys japonica* var. *villosa, Bidens radiata* var. *pinnatifida, Carex stipata, Iris ensata* var. *spontanea*; *Polygonum hydropiper*; *Athyrium filix-femina* var. *longipes, Fragaria yezoensis, Aster glehnii, Cacalia auriculata* var. *kamtschatica, Solidago virga-aurea* var. *leiocarpa, Milium effusum, Maianthemum dilatatum*; *Osmundastrum cinnamomeum* var. *fokiense, Stellaria fenzlii, Thermopsis lupinoides, Hypericum erectum, Adenophora triphylla* var. *japonica, Poa macrocalyx* var. *scabriflora, Poa pratensis, Luzula capitata*; *Onoclea sensibilis, Plantago asiatica.* Total species number 44, Species occurrence point number 155 and occurrence point number per a species 155/44=3.5

Conclusion

Since the end of the preceding Century, Notsukezaki area has been continuously utilized for grazing of domestic animals. As a result, various types of plant communities have been more or less affected by grazing pressure. As seen in the species composition of certain communities, a mixture of native plants and introduced plants is found. This type of vegetation* most certainly corresponds to Tansley's semi-natural vegetation (Tansley 1953). Tansley recognized two types of vegetation in the Nature; natural vegetation and semi-natural vegetation. He stated "If the vegetation itself is spontaneous, i. e. has occupied the ground without the aid of direct human action, but has nevertheless been partly determined or markedly modified by man or his animals, we class it as 'semi-natural vegetation'. "

Agrostis alba–Trifolium repens community of General coastal meadows is the most remarked semi-natural community. This was derived from indigenous Coastal meadows which may have been composed initially of such plants as *Festuca rubra*, *Poa macrocalyx*, *Poa pratensis***, *Carex caryophyllea* var. *microtricha*, *Dianthus superbus*, *Fragaria yezoensis*, *Rosa rugosa*, *Geranium yesoense* var. *pseudopalustre*, *Viola mandshurica*, *Halenia corniculata*, *Plantago camtschatica*, *Adenophora triphyla* var. *japonica*, *Taraxacum shikotanense* etc., and which have been subjected to the influence of grazing of domestic animals.

The same fact is found in forest communities, and is recognized mainly in the herb layer by an increase of such over-grazing indicator plants as *Agrimonia pilosa* var. *japonica*, *Fragaria yezoensis*, *Geranium yesoense* var. *pseudopalustre* and *Plantago asiatica*, and by frequent occurrence of *Sanicula chinensis* with zoochorious seed dispersal. Moreover, local abundance of *Dryopteris austriaca*, *Matteuccia struthiopteris* and *Maianthemum dilatatum*, and reduced vitality of *Sasa amphitricha* are associated with a great influence of domestic animal grazing pressure upon the vegetation.

It is an interesting problem in this area to follow the ecological succession. One example is shown in the study of the pastureland of Notsukezaki by Nishimura and Adachi (1975). They concluded that the pastureland vegetation has been changing from a *Thermopsis lupinoides-Calamagrostis langsdorffii* community or a tall-grass type of community to an

* "Vegetation" means a sum of communities.

** This species is believed to be partly native and partly introduced.

Agrostis alba community or a short-grass type of community. It is, however, hard for the present author to accept their conclusion, because the former community shares its habitat allopatrically with the latter, as seen in tables 3 to 6 and table 9. *Thermopsis lupinoides-Calamagrostis langsdorffii* community, if recognizable, belongs to a different formation. It prefers rather from wet habitats to mesic ones where an *Agrostis alba-Trifolium repens* community is established. The latter was derived from the General coastal meadow under human impacts and is, to a certain extent, in a plagioclimax stage at present.

Another example is the succession of forest communities. Notsukezaki is within the realm of Tatewakia or Cold Temperate Region, which is a transitional region from Cool Temperate Region to Boreal Region. This ecotone is characterized by a macromosaic arrangement of Boreal conifers and Temperate summer-greens. Under this condition, coniferous forests can maintain their own forests for several generations, which means that they are in the climatic climax stage. Summer-green forests of Tatewakia are different from the typical Temperate ones, because they lack *Fagus crenata* which is a climatic climax species in Tohoku District and S. W. part Hokkaido in Japan. It is, therefore, difficult to define what is the climax species in Hokkaido except for S. W. part of it. At present, *Quercus crispula* communities are prevailing in Notsukezaki area, but we can hardly find its own seedlings or saplings as the successor in the herb layer thereof, although *Acer mono* is commonly found.

Tatewaki (1958) stated that *Quercus crispula* is an edaphic climax species, particularly preferring volcanic (ash) soils as the substratum. In fact, the Oak tree communities at ponnikuri and Onnikuri appear to be a remnant of an edaphic climax, because old oak trees found there are believed to be from 190 to 220 years old, and the volcanic (ash) soils which originated from Me-Akan volcanic activities are estimated approximately 140 to 220 years old. From the fact mentioned above, it is concluded that old oak trees scattered among small oak trees appeared initially in open land, clad with Me-Akan volcanic ash deposited at least 140 years ago, and that they had overcome other summer-greens which invaded there at the same time and they have established stable communities in the course of succession. *Q. crispula* is not a true climatic climax species, but *P. jezoensis* is believed to be the true climatic climax species in Notsukezaki, because Kira's Warmth index ranges from 42 C to 52 C, which indicates the boreal coniferous region. Thus, the author agrees with Tatewaki's opinion, in that *Q. crispula* is an edaphic climax species in Hokkaido. This assumption is strengthened by the fact that conifers

saplings are frequently found in the underlayer of the *Q. crispula* community of Ponnikuri and Onnikuri.

Finally, a further work based upon the present community classification remains. This takes the form of a vegetation map. The author has published a vegetation map at a scale of 1 : 200,000 (Kankyocho 1975 & 1976), and will show a revised vegetation map of this area at a scale of 1 : 25,000 in the next paper.

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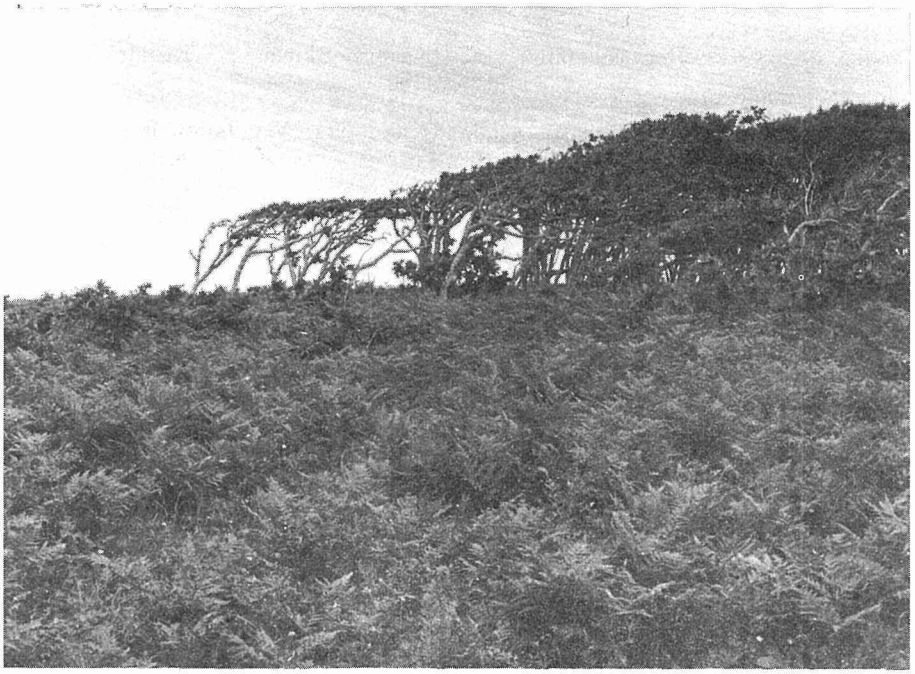

Photo 1. Physiognomy of the *Quercus Crispula* forest in Onnikuri, Notsuke.

Photo 2. Ditto.

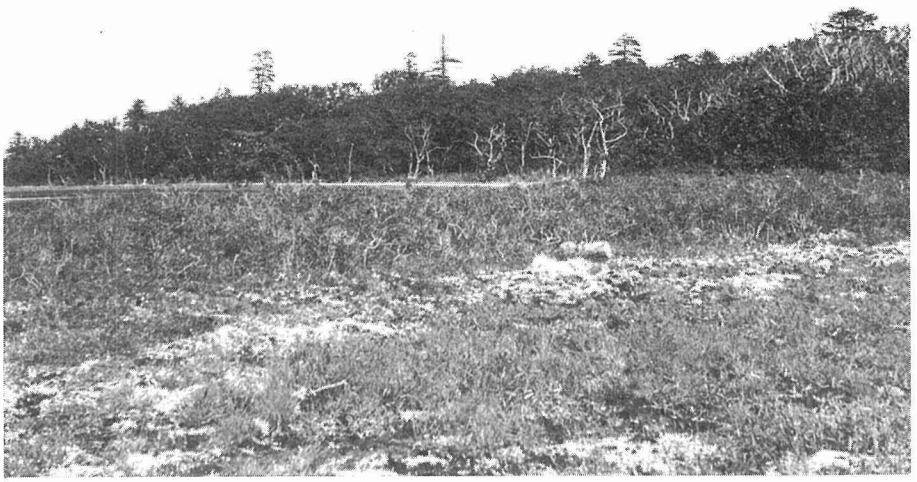

Photo 3. The forest physiongnomy on the west coast of the Ponnikuri inlet. Notice scattered Conifers form the highest over the continuous broad-leaved tree layer.

Photo 4. Regeneration of *Abies sachalinensis* under dead *Betula* and *Abies* plants.

Photo 5. The *Betula ermanii-Acer mono-Rhus ambigua* community in Onnikuri-, Notsuke.

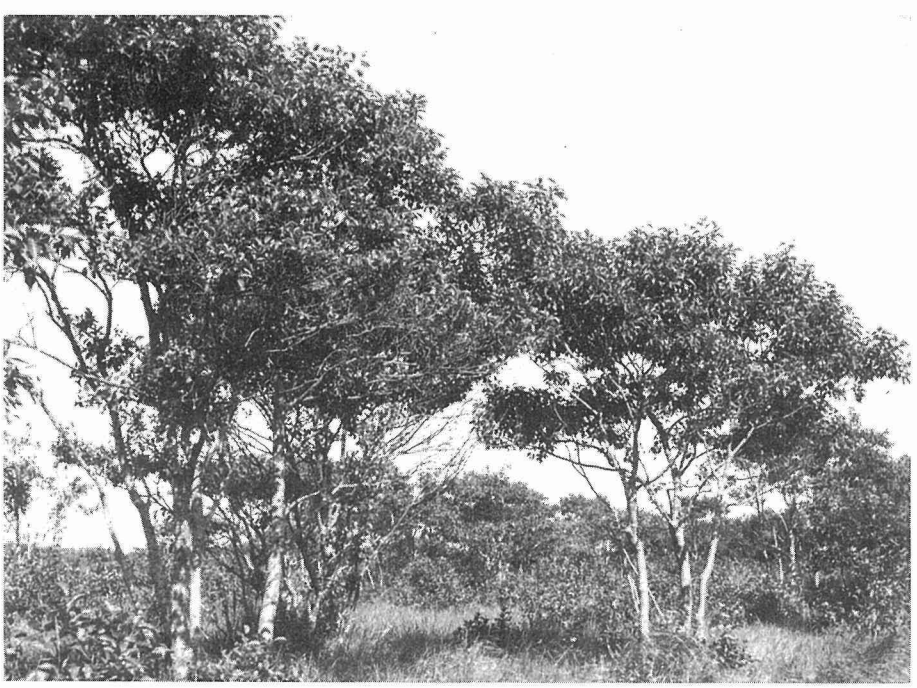

Photo 6. The *Alnus japonica* var. *arguta* community in Nakashibetsu, Notsuke.

Photo 7. Remains of the Conifer forest in Kinachausu, Notsuke. (photo taken in 1956)

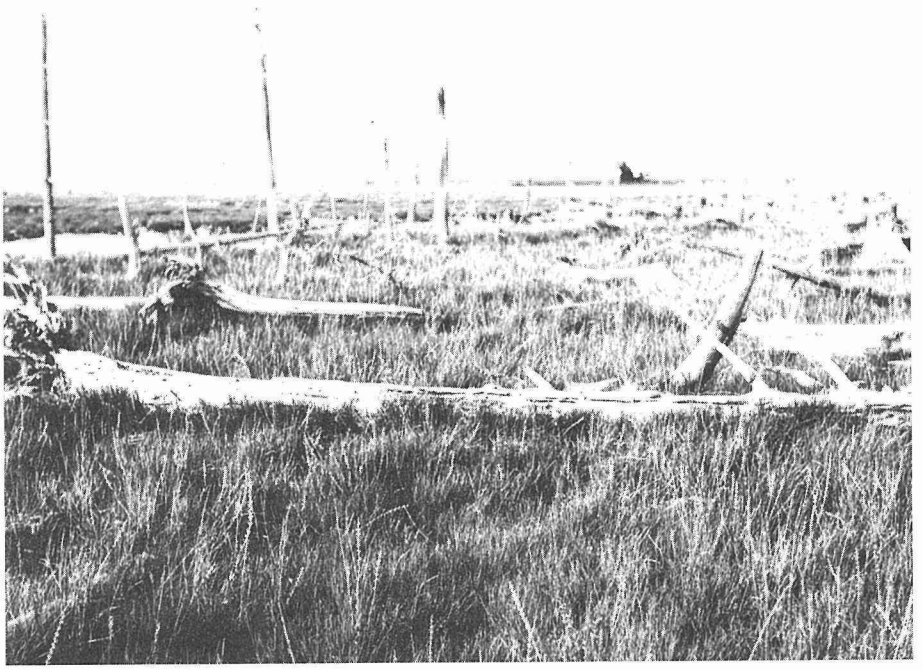

Photo 8. Ditto. (photo taken in 1963)