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Geobotanical Aspects of Simeonof Island, Shumagin Islands, Southwestern Alaska

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Zusammenfassung

Diese Publikation basiert auf vorläufigen Forschungsergebnissen einer geobotanischen Expedition im Jahr 1996 auf die nordpazifische Insel Simeonof sowie auf unveröffentlichten Ergebnissen früherer Untersuchungen im Rahmen der ehemaligen Beweidung dieser Insel. Simeonof ist eine kleine, abgelegene Insel der Shumagin Insel-Gruppe, die südlich der Alaska Halbinsel, etwa 900 km südostlich von Anchorage, im Nordpazifik liegt. Sie liegt in dem hyperozeanischen Sektor der humiden Provinz der mittleren borealen Subzone. Das geologische Substrat ist Granodiorit, überdeckt von aeolischen vulkanischen Ablagerungen. Die Insel ist etwa 10 km x 10 km groß und besteht aus zwei Teilen, verbunden durch einen Isthmus. Beide Teile bestehen aus zentralen Erhebungen (höheste Erhebung 438 m Höhe) die von ausgedehnten Flachlandbereichen umgeben sind.

Dieser Beitrag soll einen ersten geobotanische Eindruck vermitteln.

Das *Zosteretum marinae* wächst flächendeckend im Sublitoral von Simeonof Harbor. Die Sandstrandvegetation mit Rollsteinen besteht aus Dominanz-Beständen von *Honckenya peploides* mit ein wenig *Mertensia maritima* und *Achillea borealis*. Die sich anschließenden Sanddünen sind mit einer typischen *Senecio pseudo-arnica* - *Elymus mollis*-Gesellschaft bewachsen. In feuchteren Bereichen kommt eine *Poa eminens*-Vegetation vor. Die Küstenkliffe und direkt angrenzenden Bereiche sind mit kräuterreichen *Ligusticum scoticum*-reichen Vegetationstypen bewachsen. Die zonale Vegetation der mesischen Standorte wird durch eine artenreiche *Empetrum nigrum*-Zwergstrauchheide, die aus drei Typen besteht, gebildet. Die ausgedehnten Feucht- und Naßbereiche der Randzonen der Insel bestehen aus Komplexen von vielen Vegetationstypen, u.a. der *Potametea, Oxycocco-Sphagnetea* und *Scheuchzerio-Caricetea*. Artenreiche Hochstaudenfluren mit u.a. *Heracleum lanatum* und *Salix* -Bestände finden sich in windgeschützten Lagen, ebenso Erlengebüsche von *Alnus crispa*, die beschränkt sind auf tiefere Lagen mit Drainagefunktion.

Der Einfluß der früheren Beweidung auf einige Vegetationstypen und ihre Entwicklung nach Aufhören der Beweidung mit Rindern im Jahr 1983 wird diskutiert.

Wahrscheinlich bedingt durch die intermediäre pflanzengeographische Lage - Kontaktzone mehrerer Florenprovinzen - sind die meisten Vegetationstypen sehr artenreich. Bis jetzt sind 183 Bryophyten- und über 140 Flechtenarten bekannt, die überwiegend zirkumpolar oder zirkumboreal verbreitet sind. Die Phanerogamenflora enthält bis jetzt wenigstens 250 Arten, die entweder eine amphi-pazifische, eurosiberische, östlich nord-amerikanische, westlich nord-amerikanische, zirkumboreale oder zirkumpolaren Verbreitung aufweisen. Das Vorkommen von Exoten und einigen *Picea sitchensis*-Exemplaren wird diskutiert.

1. Introduction

This contribution is an extended English version of a paper presented by Fred J.A. Daniëls on the first of March 1998 during the Jahrestagung der Reinhold-Tüxen-Gesellschaft in Han-

nover, Germany („Vegetationsökologische Aspekte der Insel Simeonof, Shumagin Inseln, Alaska").

The present paper includes preliminary results of geobotanical fieldwork carried out during July 1996 by Fred J.A. Daniëls, Stephen S. Talbot, Sandra L. Talbot and Wilfred B. Schofield on Simeonof Island. The purpose of the 1996 expedition included phytosociological research of mainly the zonal dwarf-shrub heath vegetation according to the Braun-Blanquet approach (WESTHOFF & MAAREL 1973) and the continuation of inventory research of the vascular plants, lichens and bryophytes.

Moreover this paper reports some unpublished results of previous range inventory and vegetation recovery studies in connection with cattle removal from the island in 1983 (TALBOT et al. 1984, TALBOT et al. 1997a, 1997b).

2. Shumagin Islands including Simeonof Island

2.1 Topography, geomorphology and status

The Shumagin Islands are situated about 900 km southwest of Anchorage south of the Alaska Peninsula (Fig. 1). This island group is 100 km across and includes Unga, Popof, Korovin, Nagai, Chernabura, Big and Little Koniuji, and Simeonof Island plus other smaller islands.

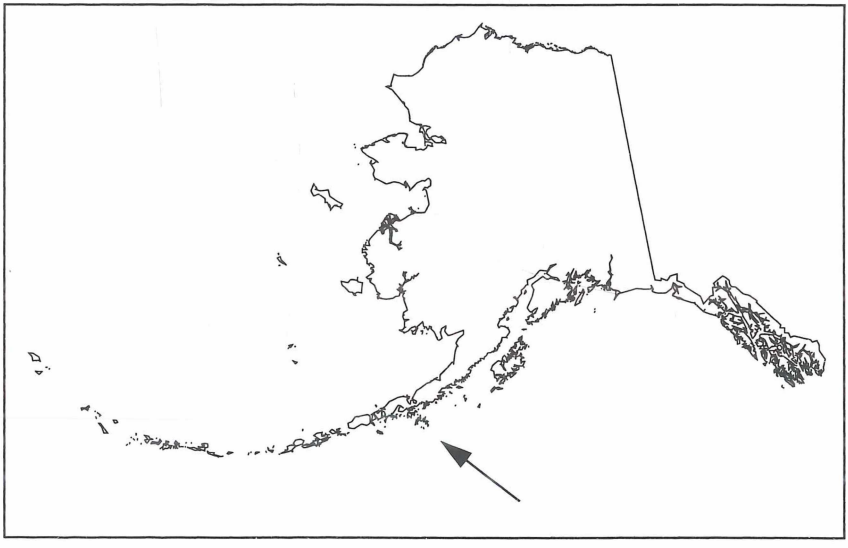

Fig. 1. Map of Alaska with location of the Shumagin Islands and Simeonof Island indicated by an arrow.

Abb. 1. Die Karte zeigt die Lage der Shumagin Inseln mit der Insel Simeonof (Pfeile).

Simeonof Island is located in the southeastern corner of the Shumagin Islands group at 54°54'N, 159°18'W. Radiocarbon dating of peat from Unga and Popov island suggests that deglaciation probably dates from 12,000 to 10,000 years BP (HEUSSER 1983).

The Shumagin Islands are mountainous with peaks of the largest islands averaging 506 m elevation (698 m maximum on Unga Island).

Unlike most of the mountains of the Shumagin Islands whose steep slopes arise abruptly from the sea, the mountains of Simeonof Island arise from extensive lowlands dotted with numerous ponds and wetlands. The largest of the three mountains is 438 m high.

Simeonof Island encompasses about 906 ha, and includes the Murie Islets. Simeonof Island is irregular in shape and approximately 10 km long and wide. The island is composed of two separate main portions which remain connected by a sandy isthmus at the head of Simeonof Harbor (Fig. 2). It is part of the Alaska Maritime National Wildlife Refuge managed by the U.S. Fish and Wildlife Service. It is also a National Natural Landmark administered by the U.S. National Park Service (SWAIN 1980). The entire island including surrounding tidelands and water column were designated as wilderness by Public Law 94-55 of 1976 and are managed according to the provisions of the Wilderness Act as amended by the Alaska Lands Act of 1980.

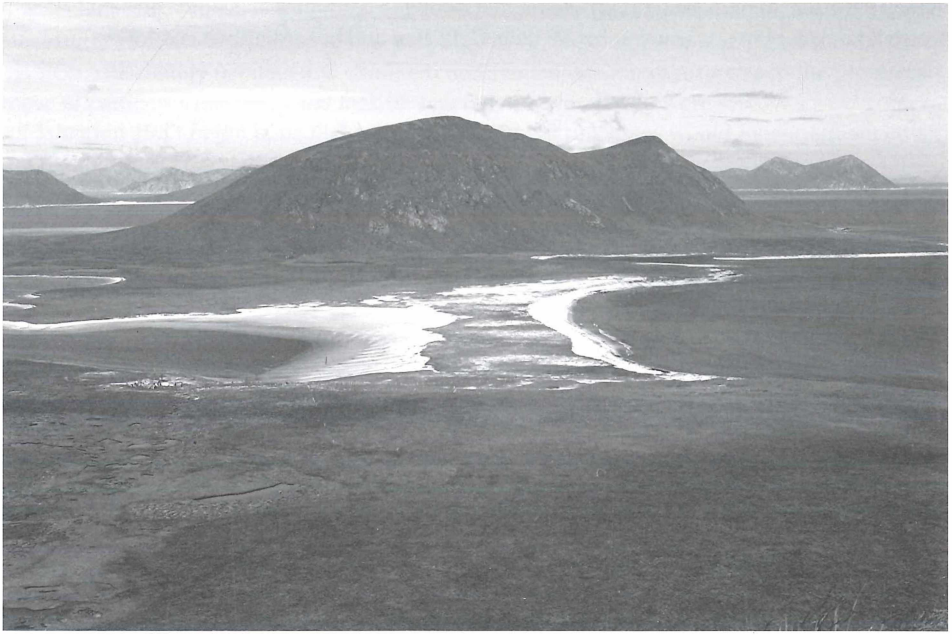

Fig. 2 The northern part of Simeonof Island showing the elevated central part and the lowlands along the coast. The middle of the picture shows the isthmus, which connects the northern part with the more extensive southern part. To the left the former ranch buildings and Simeonof Harbor. July 1996.

Abb. 2. Der nördliche Teil der Insel Simeonof mit der zentralen höheren Erhebung und den Flachlandbereichen entlang der Küste. In der Mitte des Photos sieht man den Isthmus, der mit dem südlichen Teil der Insel in Verbindung steht. Links der ehemahlige Ranch-House Komplex und Simeonof Harbor. Juli 1996.

2.2 Geology

Bedrock of the northern and central Shumagin Islands is of sandstone and conglomerate, some of which is volcanic and other plutonic rock, while the southern islands, including Simeonof, are of granodiorite (BURK 1965). The latter results in white sandy beaches on Simeonof, which are distinctly different from the dark gray volcanic sand beaches characteristic of most of the Alaska Peninsula and Aleutian Islands.

2.3 Climate

The climate of the Shumagin Islands is maritime with considerable wind and cool humid and cloudy conditions (HEUSSER 1983). Based on available climatological records for a 42-year period from Cold Bay (55°12'N, 162°42'W), approximately 180 km west northwest of Simeonof, the mean annual temperature is 3.3°C and the mean annual precipitation is 871 mm. Monthly maximum and minimum temperature variations average less than 12°C and the moderating effect of the ocean results in indistinct seasonal changes (SEARBY 1959). Using the ecoclimatic-phytogeographical system of TUHKANEN (1992), Cold Bay is in the northern boreal subzone, hyperoceanic (O2) sector, and humid (h) province. Climatic data for a shorter period (7 years) are available from Sand Point, Popov Island, Alaska (55°20'N, 160°30'W), approximately 100 km northwest of Simeonof Island; these data show a warmer and wetter climate: mean annual temperature, 4.7°C, and mean annual precipitation, 1199 mm. According to the system of TUHKANEN (1992), Simeonof Island is located in the middle boreal subzone, hyperoceanic (O2) sector, and humid (h) province. This indicates that Simeonof Island occurs in a warmer subzone than Cold Bay and accordingly has a longer growing season.

2.4 Soil

Soils of Simeonof Island are mainly Typic Cryandepts (RIEGER et al. 1979). These are well-drained, silt loam soils with a dark-colored surface horizon ranging from 7 to 37 cm thick. Most of these soils have a smeary, loam-textured subsoil developed over stratified sandy and cindery volcanic deposits. They support both grass-alder and shrubby tundra vegetation. Other soil types include Fluvaquentic Cryofibrists, on very poorly drained organic soils in depressions and broad valley bottoms; Lithic Cryofolists, on high ridges; and Typic Cryopsamments, on excessively drained soils on coastal dunes. If disturbed, the latter are subject to wind erosion.

2.5 Flora and vegetation

The phytogeographical position of the Shumagin Islands with their preponderantly boreal flora is very interesting. The islands are situated within the northern part of the Atlantic North American floristic region, but three other regions are very nearby: the Arctic-Subarctic, the (eastern) Eurosiberian and the North Pacific North American (Fig. 2.1, p. 9 in MAAREL 1993). This situation certainly accounts for a rather rich natural vascular plant flora. The vegetation of Simeonof Island is naturally treeless („maritime tundra") and primarily consists of natural coastal cliff-, meadow- and dune-vegetation, maritime and mountain dwarf shrub tundra vegetation, a variety of wetland communities and forb-, willow- and alder vegetation in sheltered sites.

2.6 Wildlife

Few marine species are resident on Simeonof Island. KENYON (1964) lists eight mammals, mostly marine, and 39 bird species. With the exception of pigeon guillemot, no breeding colonies of alcids occur on cliffs.

2.7 Habitation and plant introductions

Archaeological research revealed that the islands have been occupied for at least 4000 years and that the occupants of these islands were distinctly Aleut rather than Koniag (JOHNSON 1988). Simeonof has 18 prehistoric sites (JOHNSON & WINSLOW 1992).

In historic time the island was inhabited by only a few individuals; KENYON (1964) provides further historical notes.

Among the vascular plants eleven species are apparently exotic, introduced by cattle ranchers to Simeonof Island. They were apparently introduced in hay shipments and as garden plantings; most of these introductions, except *Rumex acetosella*, are still primarily concentrated around the ranch buildings. *Chrysanthemum leucanthemum*, an invading Eurasian species, is now a dominant species in the vegetation of the ranch area. Sexual reproduction of *Picea sitchensis* has apparently occurred from two introduced trees.

Cattle were first introduced to Simeonof in 1896 (TROYER 1968) and there are no known records indicating their initial numbers. TALBOT et al. (1984) report that livestock counts were first initiated by the Bureau of Land Management in 1961 and were continued until 1982. The number of cattle varied from 82 animals to 732, although the actually officially allotted number was 275. Cattle movement was unrestricted and apparently no grazing system was in use. A range analysis established that uncontrolled, year-long grazing was damaging the natural ecosystems of Simeonof Island (TALBOT et al. 1984). These impacts were shown to be greatest in coastal, sandy habitats that exhibited accelerated erosion in response to the preferential use of cattle of these areas and lack of vegetation cover. Cattle were removed from Simeonof Island in 1983 in the hope that natural successional processes would increase plant cover and prevent further deterioration.

Nowadays Simeonof Island is unhabitated by human settlement.

3. Previous geobotanical research

HEUSSER (1983) gave general vegetation descriptions of the poorly drained areas of broad valley floors and coastal platforms on Unga and Popof Island (Shumagin Islands) and on Cape Aliaksin (south coast of Alaska Peninsula; 55°30'N, 160°45'W). He also described several communities of better drained sites of middle and low elevations.

BATTEN & MURRAY (1993) provide an overview of the coastal vegetation of Alaska, while TALBOT & TALBOT (1994) gave a first detailed relevé-based description of the coastal vegetation of Attu, the westernmost island of the Aleutian Islands.

Syntaxonomical evaluations of the vegetation of southwestern Alaska do not exist. In this paper we can only give the first suggestions about the (higher) syntaxonomical position of the vegetation types addressed here.

Following a range inventory study in 1981 (TALBOT et al. 1984), the natural ecosystem conditions at Simeonof Island in 1995 were studied again by TALBOT et al. (1997a) to document vegetation recovery following the removal of cattle in 1983. This study was based on a set of 50 relevés according to Braun-Blanquet methods (WESTOFF & MAAREL 1973) from Simeonof Island and the Murie Islets sampled during October 1981 and July 1995; however lichens and bryophytes were not included. Moreover photo-documentation, permanent plots, numerical classification, and comparative analysis with undisturbed ecosystems were used to record changes in the vegetation. Both reports were not published. Thus published papers on the vegetation of Simeonof are still lacking until now.

4. Nomenclature

Nomenclature followed is that of HULTÉN (1968) for the vascular plants, ANDERSON et al. (1990) for the bryophytes, and ESSLINGER & EGAN (1995) for the lichens. Syntaxonomical nomenclature follows DIERSCHKE (1994).

5. Vegetation types

5.1 Sublittoral vegetation

Extensive swards of sublittoral *Zosteretum marinae* Pignatti 1953 vegetation occurs in Simeonof Harbor.

5.2 Sandy beach- and dune-vegetation

These vegetation types are associated with sandy coastal sites, beaches, beach terraces and dunes, and form the leading edge of the vegetation closest to the sea. They were mainly studied on the isthmus between Simeonof Harbor and the Pacific Ocean. Species diversity is relatively low.

The upper part of exposed sandy beaches with pebbles and debris are covered by an open *Honckenya peploides* vegetation with some *Elymus mollis* and rarely *Mertensia maritima.* The adjacent higher parts of the sandy dunes are characteristically covered by an open *Senecio pseudo-arnica - Elymus mollis* vegetation, which might reach heights of about two meters in enriched, sheltered sites.

Senecio pseudo-arnica (Fig. 3) is a characteristic species for the *Elymus mollis* dune vegetation. Constant companion species are *Honckenya peploides* and *Achillea borealis.*

These vegetation types received heavy cattle-use in 1981 and had low ground cover and active erosion in severly impacted sites (TALBOT et al. 1984). Total plant cover in 1995 has increased during the past fourteen years and natural successional processes are stabilizing these areas (TALBOT et al. 1997a).

Poa eminens vegetation is locally dominant on moist sandy places in lower parts of the dunes (dune slacks) which are probably inundated by sea water during storm events.

The vegetation types mentioned above clearly belong to the *Honckenyo-Elymetea.*

On slightly lower and moister sites a *Juncus arcticus - Festuca rubra* vegetation occurs.

Fig. 3. Close-up of *Senecio pseudo-arnica* in the sandy dunes of the isthmus. July 1996.

Abb. 3. Nahaufnahme von *Senecio pseudo-arnica* in den Sanddünen des Isthmus. Juli 1996.

5.3 Cliff-and coastal meadow vegetation

On shallow sand deposits over Typic Cryandepts near coastal cliffs a graminoid-forb *Elymus mollis - Ligusticum scoticum* sandy beach meadow vegetation occurs. The next relevé gives an impression of this vegetation type. Total cover % <100, Height 50 (90) cm, 3 m x 4 m, NE, slope 2°, 10 m above MHW, 30 m from the sea, northern part of the island close to the isthmus: *Ligusticum scoticum* 3.1fl, *Elymus mollis* 2a.1fl, *Solidago multiradiata* 2a.1fl, *Heracleum lanatum* 2a.1fl, *Achillea borealis* 2m.1fl, *Festuca rubra* 2m.1fl, *Lathyrus maritimus* 1.1v, *Equisetum arvense* 1.1v, *Fragaria chiloensis* 1.1v, *Potentilla anserina* 1.1v, *Phleum alpinum* 1.1fl, *Poa alpina* +.1fl, *Rubus stellatus* +.1v, *Taraxacum* spec. +.1v, *Ranunculus bongardi* +.1fl, *Sanguisorba stipulata* +.1fl, *Geranium erianthum* +.1fl, *Trientalis europaea* r.1v, *Galium aparine* +.1v, *Botrychium lunaria* r.1csp, *Carex macrochaeta* r.1fl, *Bryum* cf *capillare* +, *Tortula ruralis* +, *Ceratodon purpureus* +, *Brachythecium albicans* +, *Sanionia uncinata* +, and *Rhizomnium glabrescens* r.

Near the site described above, over shallow soil on steep (30%) south-facing sea-cliff ledges in a sheltered bay a species-rich *Potentilla villosa - Festuca rubra* vegetation was found to occur. Other species include *Anaphalis margaritacea, Epilobium angustifolium, Parnassia palustris, Gentiana prostrata, Carex macrochaeta, Phleum alpinum, Poa alpina, Achillea borealis, Solidago multiradiata, Trisetum spicatum, Luzula multiflora, Sagina procumbens, Hordeum brachyantherum, Ligusticum scoticum, Agrostis scabra, Gentianella amarella, Draba borealis, Rubus stellatus, Viola langsdorfii, Geranium erianthum, Polypodium vulgare, Heracleum lanatum, Campanula lasiocarpa, Peltigera rufescens, Cladonia pyxidata* and some bryophytes. The site is influenced by salt-spray and occasional water-supply from above.

5.4 Lowland and mountain dwarf shrub tundra vegetation

The zonal vegetation of Simeonof Island is an *Empetrum nigrum* dwarf shrub heath, which covers consolidated well-drained sites both in the lowlands and higher elevations.

This dwarf shrub heathland is rather rich in vascular plant species with bryophytes and lichens constituting a rather well developed moss-layer.

Dominant is *Empetrum nigrum*, other constant species (constancy IV and V) include the vascular plants *Carex macrochaeta, Vaccinium vitis-idaea, Festuca rubra, Salix arctica, Ledum decumbens, Angelica lucida, Listera cordata,* the bryophytes *Dicranum scoparium, Polytrichastrum alpinum, Pleurozium schreberi, Sanionia uncinata, Hylocomium splendens, Rhytidiadelphus triquetrus, R. loreus* and the foliose lichens *Peltigera membranacea, P. aphthosa* and *Lobaria linita*. Total species per relevé (16 m^2) ranges between 35 and 60.

The lowland and lower-middle slope dwarf shrub heaths occur on Typic Cryandept soils and are floristically characterized by several constant vascular plant species such as *Rubus stellatus, Trientalis europaea, Epilobium angustifolium, Cornus suecica, Arctostaphylos uva-ursi* and *Viola langsdorfii.*

The hummocky lowland heath is differentiated by a.o. *Geranium erianthum, Gymnocarpium dryopteris, Prenanthes alata* and *Sanguisorba stipitata* against the lower-middle slope heath, which is differentiated against the hummocky lowland heath by about 25 species including the vascular plants *Polygonum viviparum, Arctostaphylos alpina, Rhododendron camtschaticum, Huperzia selago, Epilobium latifolium* and many mosses and lichens.

The more exposed upper slope and mountain dwarf shrub heath is differentiated by a.o. *Carex circinnata, Loiseleuria procumbens, Tofieldia coccinea, Cassiope stelleriana, C. lycopodioides* and many arctic-alpine circumpolar chionophobic lichens and bryophytes, such as

Cladonia amaurocraea, Ochrolechia frigida, Cetraria ericetorum, Alectoria nigricans, A. ochroleuca, Aulacomnium turgidum and *Gymnomitrion corallioides*. This dwarf shrub heath is rich in cryptogams and occurs on soils classified as Lithic Cryofolists. It locally shows severe damage by wind erosion (Fig. 4).

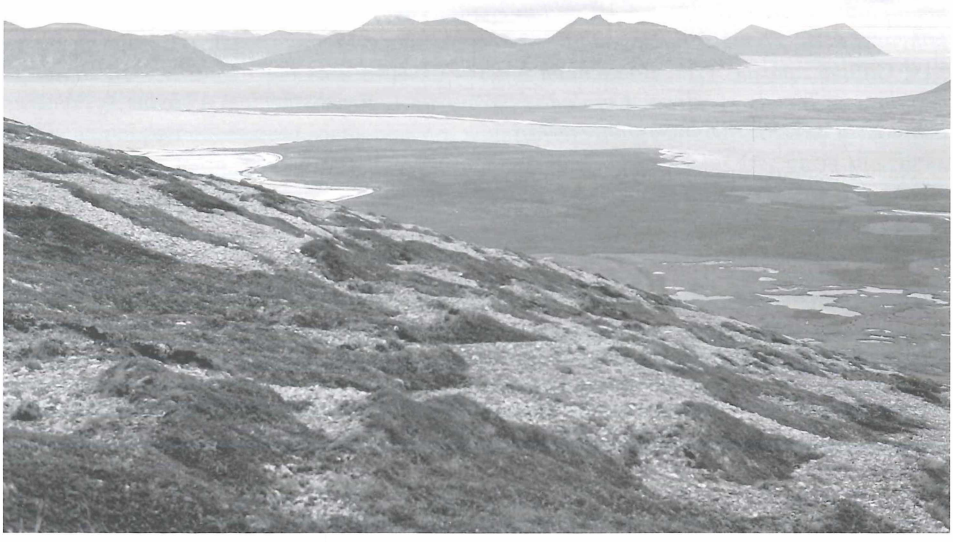

Fig. 4. Foreground mountain dwarf shrub heath (cf. *Loiseleurio-Diapension*) affected by strong wind erosion on the southern part of the island. Altitude abt. 250 m. July 1996.

Abb. 4. Winderodierte Zwergstrauch Heide (cf. *Loiseleurio-Diapension*) in den höheren Lagen des südlichen Teiles der Insel. Höhenlage etwa 250 m NN. Juli 1996.

The syntaxonomical position of these heathland communities is still under study. The question - one or two associations?- still has to be answered. The lowland and middle slope communities have many species in common with the *Empetrion nigri* and *Phyllodoco-Vaccinion* communities, the mountain type with associations of the *Loiseleurio-Diapension* (cf. DANIËLS 1982).

According to TALBOT et al. (1984) the dwarf shrub heath vegetation was relatively undisturbed in 1981 and cattle use was the lowest of all community types investigated.

Comparisons of dwarf shrub heath study sites between 1981 and 1995 showed few floristic differences (TALBOT et al. 1997a). The upper slope and mountain heath was very probably little influenced by cattle.

5.5 Wetlands

The wetlands of Simeonof constitute an extensive complex of a great variety of plant communities of lakes, ponds, mires, bogs, springs, drainage streams and runnels, occuring as a fringe around the mountains on poorly drained sites. This important complex was not studied, but the following might give an impression of some vegetation types in the near surroundings of former ranch-house.

Carex lyngbei vegetation borders sheltered margins of shallow lakes with mud-bottom. Companions are *Equisetum arvense* and *Utricularia minor*. Communities of *Sparganium hyperboreum* and *Potamogeton* species (a.o. *P. alpinus, P. filiformis, P. perfoliatus*) (*Potametea pectinati*) occur in small ponds.

The extensive hummocky bog complexes (*Oxycocco-Sphagnetea*) are influenced by salt spray and soil water, due to the shallow peat layer. A representative relevé (1,5 m x 1,5 m) of a typical *Empetrum nigrum - Betula nana - Sphagnum fuscum* vegetation includes *Empetrum nigrum, Betula nana, Ledum decumbens, Andromeda polifolia, Cornus suecica, Salix barclayi, Vaccinium uliginosum, V. vitis-idaea, Arctostaphylos alpina, Rubus chamaemorus, Equisetum arvense, Drosera rotundifolia, Pinguicula vulgaris, Carex livida, Calamagrostis* spec., *Carex lyngbaei, Trientalis europaea, Eriophorum* spec. and a.o. the lichens *Cetraria cucullata, C. ericetorum, Cladina arbuscula, C. rangiferina, C. pacifica, C. stellaris, Cladonia maxima, C. uncialis*, and bryophytes *Hylocomium splendens, Rhytidiadelphus loreus, Racomitrium lanuginosum, Aulacomnium palustre, Sphagnum fuscum, S. rubellum, Mylia anomala* and many others.

Scheuchzerio-Caricetea vegetation is represented by the next vegetation types.

Carex saxatilis vegetation occurs in small shallow, often temporary pools in peatlands. Near small creeks with slowly running water patches of mossy rich-fen vegetation are found. Typical species of such sites includes *Iris setosa* (Fig. 5), *Swertia perennis* and *Erigeron peregrinus,* several orchids and mosses such as *Tomenthypnum nitens* (very rare), and *Campylium stellatum.*

On level mineral soil in erosion runnels probably initiated by former cattle-trampling a species rich *Juncus biglumis - Scorpidium scorpioides* pioneer vegetation occurs with

Fig. 5. Close-up of a rich-fen vegetation with *Iris setosa* along a small streamlet in the wetland area behind the former ranch buildings. July 1996.

Abb. 5. Nahaufnahme einer Flachmoor-Vegetation mit *Iris setosa* entlang eines kleinen Baches in den Feuchtbereichen hinter dem ehemahligen Ranch-Komplex. Juli 1996.

Deschampsia beringensis, Equisetum arvense, Pinguicula vulgaris, Juncus alpinus, J. biglumis, Trichlogin palustre, Utricularia minor and *Scorpidium scorpioides.*

5.6 Forb- and willow vegetation

This vegetation commonly occurs on sheltered sites both in the lowlands and in the mountains. They might be classified provisionally into the *Betulo-Adenostyletea.*

The low elevation *Heracleum lanatum - Epilobium angustifolium* forb meadow vegetation occurs on mesic sites on low microhummocks in lowland areas. Characteristic species include the forbs, *Achillea borealis, Aconitum maximum, Angelica lucida, Epilobium angustifolium, Geranium erianthum, Heracleum lanatum, Ranunculus bongardi, Rubus arcticus*, and *Trientalis europaea*, and the graminoids, *Agrostis scabra, Carex macrochaeta, Festuca rubra* (low cover) and *Phleum alpinum.* In 1981 a *Festuca rubra-Agrostis scabra* graminoid meadow vegetation, which was characterized by moderately high cattle use, occurred where nowadays the *Heracleum lanatum-Epilobium angustifolium* community occurs (TALBOT et al. 1984, 1997a). Characteristic species are the forbs, *Achillea borealis, Angelica lucida, Gentianella amarella,* and *Rubus arcticus*, and the graminoids, *Agrostis scabra*, and *Festuca rubra* (high cover). Thus there is some evidence indicating a shift in floristic composition from graminoid to forb-dominated communities over time following cattle removal.

On the rather steep southeastern exposed sheltered midslope of the lower mountain of the southern part of the island, a very species-rich forb vegetation was found to occur (cf. *Calamagrostion* of the high-montane/subalpine zone of some Middle-European mountains). The next relevé gives an impression of this vegetation type. Slope 30°, SE, 3 m x 4 m, sheltered site in slope, abt. 150 m altitude, humus-rich loamy soil over boulders and bedrock. Total cover <100%, height 30 cm (-70 cm):

Heracleum lanatum 2b.1fl, *Viola langsdorfii* 2b.1fr, *Salix arctica* 2b.3fl, *Cornus suecica* 2a.1fr, *Platanthera huronensis* 1.1fl, *Cypripedium guttatum* 1.1fr, *Polygonum viviparum* 1.1fl, *Achillea borealis* 1.1fl, *Prenanthes alata* 1.1v, *Athyrium filix-femina* 1.1csp, *Dryopteris phegopteris* 1.1v, *Ledum decumbens* 1.1fr, *Solidago multiradiata* 1.1fl, *Cardamine pratensis* 1.1fl, *Festuca rubra* 1.2fl, *Agrostis* cf *scabra* 1.2fl, *Calamagrostis* spec. 1.1fl, *Polypodium vulgare* 1.1v, *Vaccinium vitis-idaea* 1.1v, *Moehringia laterifolia* 1.1fl, *Botrychium virginianum* 1.1csp, *Phleum alpinum* 1.1fl, *Rubus stellatus* 1.1v, *Poa* cf *pratensis* 1.1fl, *Trisetum spicatum* 1.1fl, *Angelica lucida* +.1v, *Epilobium angustifolium* +.1kn, *Aconitum maximum* +.1kn, *Anaphalis margaritacea* +.1fl, *Geranium erianthum* +.1fl, *Orobanche fasciculata* +.1fl, *Gymnocarpium dryopteris* +.v, *Empetrum nigrum* r.1v, *Trientalis europaea* +.1fr, *Sanguisorba stipulata* +.1v, *Luzula* cf *multiflora* +.1fl, *Arctostaphylos uva-ursi* +.1v, *Anemone narcissiflora* +.3fr, *Ranunculus bongardi* +.1fr, *Coeloglossum viride* r.1fl, *Pedicularis verticillata* +.1fl, *Pyrola* spec. r.1v, *Rhytidiadelphus squarrosus* +, *R. triquetrus* +, *Sanionia uncinata* +, *Dicranum scoparium* +, *Lobaria linita* +, *Pleurozium schreberi* +, *Antitrichia curtipendula* +, *Hylocomium splendens* +, *Peltigera membranacea* +. There are 53 species in all!

Other sheltered mesic sites on the lower and midslopes of the mountains with occasional extra water supply are covered by a variety of other community types of forbs and willows.

5.7 Alder vegetation

This „*Betulo-Adenostyletea*" vegetation forms the tallest vegetation in the area. It is averaging three to four meter in height. This *Alnus crispa - Rubus spectabilis* vegetation is associated with wind-protected drainage systems in middle and lower slopes of the mountains and locally occurs as extensive stands. It is often surrounded by a fringe of tall-forbs. Character-

istic species include deciduous shrubs, *Alnus crispa*, which is dominant, *Rubus spectabilis,* and *Sambucus racemosa,* forbs, *Aconitum maximum, Circaea alpina,* and *Dryopteris dilatata*, and graminoids such as *Calamagrostis canadensis*.

A typical epiphytic lichen flora (*Lobarion*) occurs including *Pseudocyphellaria crocata, P. anomala, Lobaria scrobiculata* and *Peltigera collina*.

Relevé descriptions from 1981 and 1995 show little floristic difference (TALBOT et al. 1997a). Cattle use of areas with alder shrub vegetation in 1981 was relatively low (TALBOT et al. 1984).

6. Comparisons with vegetation from neighboring areas

Studies of the coastal vegetation of other Aleutian Islands and the Alaska Peninsula are rare. However, a study of the coastal vegetation of Attu Island (TALBOT & TALBOT 1994), the westernmost island in the Aleutian Islands, shows high similarity to some of the coastal communities of Simeonof Island, particularly the Attu beach community types, ‚*Honckenya peploides*' and ‚*Mertensia maritima*', and the beach meadow community type, ‚*Elymus mollis-Senecio pseudo-arnica*'. The other Attu Island beach meadow type, *Lathyrus maritimus-Elymus mollis*, has higher cover of *Lathyrus maritimus*. Meadow communities of Attu Island occur on stabilized dunes, where they are well developed and richer in species than Simeonof.

There is also a close similarity between the coastal sandy beach vegetation at Simeonof Island and Izembek National Wildlife Refuge located 180 km west northwest. Characteristic beach species at Izembek include *Elymus mollis, Honckenya peploides, Lathyrus maritimus, Ligusticum scoticum, Mertensia maritima*, and *Senecio pseudo-arnica*. However, there is greater abundance of *Lathyrus maritimus* and *Ligusticum scoticum* in the beach meadow communities at Izembek NWR than at Simeonof. The lower abundance of these two species on Simeonof relative to Izembek and Attu Island may have resulted from a lag effect at Simeonof and these species may not have fully reestablished following heavy grazing pressure.

In the Aleutian Islands, the principal human activity in modern times was associated with World War II, when there was often intense activity, including combat, on some of the beaches, which caused considerable disturbance. For example, in the nearly 50 years since Attu Island was part of the war, the vegetation of the eastern beaches and dunes has recovered (TALBOT & TALBOT 1994). For the past 30 years on Attu Island, the only year-round human residents are stationed at Navy Cove with the U.S. Coast Guard, and their number is fewer than 30. In relation to Simeonof Island where disturbance from cattle ended about only fifteen years ago, Attu Island has had a longer period to recover from disturbance. Therefore, Simeonof Island, which has generally similar climatic conditions to Attu Island, shows significant vegetation recovery, although it still appears to be in the initial stages.

7. Remarks on the flora of Simeonof Island

Preliminary investigations revealed more than 183 species of mosses and more than 67 species of hepatics (SCHOFIELD 1997, unpublished). Most of the species, about 83% in the mosses and 88% in the hepatics show an wide northern-hemispheric boreal and arctic distribution. Species confined to eastern Asia and western North America are rather few: 8 species of mosses, 8 species of hepatics.

Preliminary investigations revealed more than 140 species of lichens (TALBOT et al. 1997b). Many species show a wide northern hemispheric distribution.

Vascular plant flora comprises at least 250 species belonging either to amphi-pacific, Eurosiberian, eastern North American, western North American, circumboreal or circumpolar distribution types.

Introduced species included in 1981 *Anthoxanthum odoratum, Chrysanthemum leucanthemum, Fragaria virginiana, Holcus lanatus, Picea sitchensis, Plantago major, Rheum rhaponticum, Rumex acetosella*, and *Stellaria media*. Some of these were deliberately planted in the garden (i. e., *Fragaria virginiana* and *Rheum rhaponticum*) and *Picea sitchensis* was planted as an ornamental. Other species are weedy exotics such as *Anthoxanthum odoratum, Chrysanthemum leucanthemum, Holcus lanatus, Plantago major, Rumex acetosella,* and *Stellaria media*. These introduced weeds are usually in close proximity to the old ranch buildings.

In 1995 and 1996 garden plantings still remain where they were originally planted beside the ranch house.

Weedy exotic species, such as *Anthoxanthum odoratum, Chrysanthemum leucanthemum, Holcus lanatus, Plantago major, Rumex acetosella*, and *Stellaria media*, were presumably introduced with hay. With the exceptions of *Holcus lanatus, Plantago major*, and *Rumex acetosella*, the introduced weeds are usually in close proximity to the old ranch buildings. Additionally, all weedy species occur only occasionally except *Chrysanthemum leucanthemum*, which is a dominant. *Rumex acetosella* was the most frequently occuring species beyond the ranch buildings. This species was recorded in a wide variety of vegetation types. *Rumex acetosella* was recorded on Simeonof Island in 1981 (TALBOT et al. 1984) and in 1995 (TALBOT et al. 1997a). Originally introduced from Europe, *R. acetosella* is a troublesome weed that spreads by seeds and fragile rhizomes that easily break into pieces that can resprout (POJAR & MACKINNON 1994).

Two other species, *Holcus lanatus* and *Plantago major*, were recorded beyond the immediate environs of the ranch. The former was recorded once in 1995 in *Heracleum lanatum-Epilobium angustifolium* forb meadow and the latter was recorded once in 1981 in an *Elymus mollis* sandy beach meadow. *Plantago major* was not observed in 1995 and 1996. The presence of *Holcus lanatus* on Simeonof Island supports the hypothesis that some of the weeds may have been introduced with hay. It is known that *Holcus lanatus* (sweet vernalgrass) was used as a component of cured hay because of the sweet smell of the plant (POJAR & MACKINNON 1994).

One species, *Chrysanthemum leucanthemum* appears to be dominant and invasive in the old ranch area. As noted by POJAR & MAKKINNON (1994), it is an introduced weed of European origin that is widespread and often abundant in disturbed places. They further observe that it invades fields and meadows where it competes aggressively, especially under grazing pressure, to form dense and extensive populations. It has formed dense and extensive populations on about 2-3 acres around the old ranch area and also appears to be invading areas bordering the ranch environment.

8. Arboreal growth

The occurrence of introduced *Picea sitchensis* on Simeonof Island is of interest. The present mature trees (2), which were planted in a rather wind-swept heath, are now in a state of rapid decline with only one or two branches of trees still bearing living needles. However, young Sitka spruces about 0.5 m in height are apparently regenerating from seed only a short distance (20-30 m) from the parent trees. TUHKANEN (1984) stated that it is somewhat disputable whether the Aleutian Islands lie within the climatic limit for arboreal growth. He refers to GRIGGS (1934) whose opinion was that the forest simply had not time to return to the

islands after the Ice Age. It is known that the forest limit and tree-line have certainly advanced westwards on Kodiak Island during the present century (BRUCE & COURT 1945, BEALS 1986, VIERECK 1979:231). Successful planting experiments have been carried out with *Picea sitchensis* on Unalaska Island and the trees have produced cones, but there has been no firm evidence of spontaneous reproduction (GRIGGS 1934). VIERECK & LITTLE (1972:56) suggested that the reason for this was grazing, while HULTÉN (1968) regarded *Picea sitchensis* as simply incapable of sexual reproduction. It should be noted that like Cold Bay, Unalaska Island, falls within the northern boreal regime and has a less favorable thermal regime for woody growth than does Simeonof. According to COLINVAUX (1967) there was spruce on the Aleutian Islands at one time during the post-glacial period, but it retreated later as a result of climatic deterioration. The occurrence of sexual reproduction of introduced *Picea sitchensis* on Simeonof Island suggests that within the middle boreal subzone absence of spruce may be attributed to historical reasons; given more time the species may return naturally to Simeonof Island.

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