Det Kgl. Danske Videnskabernes Selskab.
Biologiske Meddelelser. **VI**, 3.

THE FLORA OF GREENLAND AND ITS ORIGIN

BY

C. H. OSTENFELD

KØBENHAVN
HOVEDKOMMISSIONÆR: ANDR. FRED. HØST & SØN, KGL. HOF-BOGHANDEL
BIANCO LUNOS BOGTRYKKERI
1926

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I. Introduction.

The part of Greenland whose flora was the last to be investigated is the northernmost — as is indeed but natural, this being the most inaccessible portion of that great country. However, thanks to the expeditions of the last decades: the Danmark Expedition, the First and Second Thule Expeditions, the Jubilee Expedition, etc., collections of not inconsiderable extent have been brought home from Greenland north of 76° N. Lat. During recent years also, many other parts of the country have been subjected to closer botanical investigation; in the case of the West Coast, more especially through journeys undertaken by mag. sc. M. P. Porsild, Director of the Danish Arctic Station, and his sons. We may then, I think, fairly say that the floristic side of the investigation of Greenland's vegetation has reached a natural conclusion. This applies, however, only to the so-called "higher plants", i. e. phanerogams and pteridophytes. Of these, we can hardly expect any great number of fresh finds in the future. It is otherwise, however, with the cryptogams (apart from the pteridophytes). Their occurrence is but incompletely known, though here also we have fairly numerous and comprehensive works in all sections. The approximate number of species for each of these groups is stated as: 600 bryophytes, 300 lichens, 185 marine algæ, 375 fresh-water algæ, 600 diatoms (marine and fresh-water) and 45 dinoflagellates (marine and fresh-water); such figures are

however, especially for the microscopical forms — the majority —, altogether uncertain, and at any rate purely minimal values.

Still less is known as to the cryptogams in the surrounding countries; the greater part of the enormous Arctic-American Archipelago for instance is very little explored in this respect. It would, therefore, be a matter of considerable difficulty to attempt any comparison between the cryptogams of Greenland and those of adjacent territories on the west and east.

It would be useless, then, to put forward any phytogeographical observations on the basis of the flora as a whole; it must suffice to take the phanerogams and pteridophytes, which, as being the more conspicuous forms, are also collected by travellers other than professional collectors.

The distribution of these plants in the different areas along the vast extent of Greenland's coast is now also, I think, fairly well known in the main; and we are hardly likely to find great alterations in the distribution of species as at present known in Greenland, any more than we should look for a noteworthy increase in their number.

Having for some years past been occupied in dealing with collections brought home by the above mentioned — and other — expeditions to Greenland, I think the time has now come for a critical survey of the distribution of the species throughout the whole country, with a view to arriving at an understanding of the origin of the flora — only, however, so far as concerns the phanerogams and pteridophytes.

A critical estimate of the flora of Greenland is in many ways a difficult matter, and necessarily also to some extent a matter of judgement. The most conspicuous difficulty lies

in the delimitation of the species. By experimental investigations we may get to the point where we have only to deal with the actually smallest systematic units; this, however, is out of the question here, where the material consists of dried specimens, or specimens preserved in spirits. It is, therefore, inevitable that some difference should be apparent between the views of the various writers as to what should be considered as a species. True, in most cases, the species are taken more or less in a Linnean sense; but in certain genera (e. g. *Taraxacum*, *Hieracium*), the minor systematic units are so well distinguished as to be recognisable even in preserved material. In other genera, especially those where hybridisation is presumably of frequent occurrence (e. g. *Draba*, and to some extent also *Potentilla*), we must needs be content with larger and more capacious species.

This is, of course, unfortunate, inasmuch as it gives rise to a lack of uniformity in treatment which renders comparison difficult. Furthermore, it often means the effacement of features that might otherwise have presented valuable indications as to the course of migration of a species, as the more comprehensive species, such as *Drapa alpina* for instance, have on the whole very wide areas of distribution, and it is likely that, once clear as to the minor systematic units composing such a collective species, we might be able to say whence the form occurring in a given area originated. As it is, this can only be done in rare cases. For the present, we must be content with very wide limits for our species in most of the genera or groups.

And again, even though we may, in the case of a single large area, have reached a step further in the distinction of species, the greater accuracy thus obtained has to be re-

linquished when making comparison with other areas, as the data for species there found have not attained the same degree of precision, and there is thus a danger of forming conclusions which may sometimes be far more misleading than those based on the larger specific units. For before we can make use of more specialised knowledge of the forms (species) in a genus or group, it is necessary that they should have been investigated on the same principles throughout the entire area of distribution of the genus or group, as the case may be. This is a point very frequently neglected in phytogeographical works. It has happened, for instance, that the micro-species occurring in America have been critically investigated, without the same regard to the micro-species occurring in other continents, and vice versa; I am here thinking mostly of the colder parts of North America and the corresponding portions of Asia and Europe, which must necessarily be included in the investigation.

With these general observations in mind, we will now proceed to consider the Greenland flora and its origin. The number of species, which, as will appear from the foregoing, is somewhat arbitrary, amounts, in my estimation, to 390 phanerogams and pteridophytes for the whole of Greenland.[1] It is not a great number for so vast an extent of territory. But it must be borne in mind that the whole interior of Greenland is covered by ice, and that the climate is unfavourable for vegetation both on account of the northerly situation and the intense cold generated by the mass of the inland ice itself; finally also on account of the cold currents in the surrounding seas. These three circumstances also partly account for the slight difference between the vegetation of

[1] This does not include the few species introduced during the past two centuries through human agency and partly acclimatised.

the north coast and that of the southern extremity — far less than one would expect considering that some $23^1/_2$ degrees of latitude are involved. No fewer than 32, or 8,2 p. c,, of the 390 species in the country have a range of distribution extending from the northern to the southern extremity; a feature which is probably rather unique. And these 32 species, moreover, themselves comprise nearly half (42 p. c.) of the whole poor flora (77 species) of the north coast.

Still, there is of course a much richer flora in southern Greenland, with its high birch copses, than on the inhospitable north coast, fronting the Polar Sea which is always covered with ice; we have here the most northerly vegetation known. It is natural therefore to endeavour to divide up the country, or rather, the coasts, into minor areas, when studying the flora and its distribution throughout the country. This will be done in the following, as previously also by E. WARMING, A. G. NATHORST, M. P. PORSILD and others.

The 390 species and their distribution in Greenland, together with various phytogeographical data, will be found in the General List at the close of this paper. This list gives really all the data on which the present work is based.

II. Previous Investigations.

The floristic-phytogeographical conditions of Greenland have been dealt with at quite considerable length in previous papers by different authors. WARMING, in his book on the Vegetation of Greenland (1888), the first ecological description of the vegetation of the country, also deals, in one chapter, with the composition and origin of the flora, and gives a summary of what was previously known, epsecially

I. D. Hooker's Outlines of the Distribution of Arctic Plants (1860). At that time, very little or nothing was known as to the distribution of the flora throughout great parts of Greenland (this applies, for instance, especially to the northernmost parts, and most of the east coast), therefore the material was insufficient on which to base final conclusions.

Warming arrived at the following conclusions (some of which had already previously — in 1880 — been formulated by Joh. Lange) [translated from Danish]:

"There is no reason why the main bulk of the vascular plants of Greenland should not have survived the Ice Age in the country itself, after which they have successively spread out over the exposed territory. Immigration from other countries may also have taken place across the sea to all parts of the country; most easily, however, to the northernmost parts, and to south and south-east Greenland. There is no reason to assume any post-glacial immigration over a connected belt of land from Europe. The slight surplus of European types as compared with American in Greenland is due to the greater abundance of European types in South Greenland; and their presence here is sufficiently explained by the similarity of climatic conditions to those of western Europe, and by a greater facility for plant migration, from Iceland especially, to South Greenland than from America to the southern and middle parts of Greenland. Greenland is thus not a province of Europe in phytogeographical respects; has no connection with Europe in regard to its evolutionary history, at any rate post-glacially; indeed, it seems to me most likely that, especially as regards the southern parts of Greenland, no such connection existed since perhaps as far back as the middle of the tertiary period. Greenland will doubtless prove on the whole to be

nearer North America, but has, however, such peculiarities that it must be regarded as a separate entity."

In the French summary of the above work (p. 245) WARMING says more definitely: "ce n'est pas le détroit de Davis — comme HOOKER l'a supposé — mais plutôt le détroit de Danemark, entre le Groenland et l'Islande, qui forme la ligne de separation entre la flore européenne et la flore americaine."

This view was strongly opposed by the Swedish botanist and geologist A. G. NATHORST (1890). From the absence of western types in East Greenland between 63°—66° N. Lat., we should, in his opinion, draw the dividing line between American and European flora there, so that the inland ice, and not Danmark Strait, should form the actual boundary; furthermore, by far the greater part of the flora must have immigrated, since the glacial period, to West Greenland from North America, which view was supported by the fact that the western types are most numerous in West Greenland between 64° and 69° N. Lat, where the distance to America is least (except for the far north); the flora of East Greenland had probably immigrated via some postglacial land connection with Iceland.

NATHORST's criticism at once (1890) elicited a sharp retort from WARMING, who rightly pointed out, *inter alia*, that it was a remarkable method of proceeding, to take as the crucial point of the proof an area (East Greenland 63°—66° N. Lat.) from which [at that time] hardly any plants were known at all. WARMING also drew attention here to the probable importance of the ancient Norse colonisation as a factor in the development of the South Greenland flora. The discussion closed with a further sharp reply from NATHORST (1891) with the result that the two old

friends were for some years bitterly hostile towards each other.

Since then, the question has been suffered to lie in abeyance, as botanists have realised that before anything new could be said, it would be necessary to know much more about the flora of the whole of Greenland and adjacent countries. It may be mentioned, however, that L. Kolderup Rosenvinge (1897) dealing with the vegetation of South Greenland, mentions the Norse colonisation as of importance to the composition of the flora.

In 1913, the Swedish botanist H. G. Simmons published an important paper on the phytogeography of the Arctic-American archipelago, at the end of which he also touches on the question of Greenland's flora, and agrees with Nathorst in regarding it as mainly post-glacial; on the other hand, he sides with Warming in considering it as chiefly Arctic-American.

M. P. Porsild (1921) in a brief survey, follows Simmons and Nathorst in assuming that the entire flora of Greenland must have immigrated in post-glacial times. As regards the routes of this immigration, he points out that part must have come from the north-west via Smith Sound, and some few from the north-east. Possibly this first immigration route may have been of greater importance than would at first be supposed, as the post-glacial heat maximum recently found (see p. 47) may have rendered this route practicable for species which cannot now exist so far to the north. He emphasises the importance of the ancient Norse colonisation in regard to the immigration of the southern forms in South Greenland, but points out at the same time that various southern species of American origin cannot have come in by this means; they must have been brought

overseas by wind, water or birds, as is also the case with a not inconsiderable number of other southern species.

The above is, briefly, what is given in extant literature, from WARMING (1888) up to the present time, as to the Greenland flora and its origin. My own studies do not amount to any revolution relative to the views here expressed; they form, rather, a natural development based on our better knowledge at the present day as to the flora and the geographical distribution of its species.

III. The Age of the Flora in Relation to the Glacial Period.

As to the age of the Greenland flora this question cannot be answered with any certainty. In the Cretaceous and older Tertiary periods Greenland had a warmly temperate flora, the remains of which are known *i. a.* from deposits in central West-Greenland (the Vaigat district), this flora being now naturally extinct in Greenland.

In arctic and subarctic to coldly temperate regions there is, at the present time, a flora whose species for the greater part have a circumpolar distribution. It is a natural supposition that this flora in pre-glacial times lived in the polar regions and was gradually driven south, according as the ice gained the upper hand. The question which interests us in this connection is whether the most hardy of the species of this flora, viz.: those which at the present time live in the most northerly plant-bearing regions, may have survived the maximum of the glacial period in Greenland. I do not mean that they have continued to exist in the same place since before the glacial period, but for instance that by the action of the ice they were driven down to southern Greenland, and from there, at a later period, again migrated towards the north.

This question must, I think, be answered in the affirmative, and this I chiefly base on the find of "higher plants" in the present "nunatak"[1] areas. There is every probability that even during the maximum extension of the inland ice there were "nunatak"s: rocky walls, ledges etc. free of ice, and where their situation was favourable, they were undoubtedly able to harbour a very hardy vegetation. Particularly convincing, it seems to me, in this respect is the occurrence of 8 species in a small "nunatak" area near the north coast, in about 81° N. Lat. which locality was passed by the Second Thule Expedition in 1916 and called by them the "Midgaardsorm" (i. e. The Midgard Snake). The conditions prevailing within this small area are properly speaking those of the glacial period, but in spite of this a few hardy species have been able to live there. They belong to the species which I call high-arctic (3 species) and arctic[2] (5 species). From three other "nunatak"s plants were collected in 1878 by A. Kornerup and J. A. D. Jensen, the latter nunataks being situated at some distance from the margin of the inland ice, in southern West-Greenland (near 63° N. Lat.)[3], thus under much milder conditions, but at a height of between 1000 and 2000 metres. On each "nunatak" there were 26—27 species, naturally in part the same; however the total number of species was 54, of which 40 are arctic, 3 high-arctic and 11 subarctic and boreal[4].

[1] "Nunatak" is a Greenlandish word which means a cliff or mountain surrounded by and emerging from the inland ice, and not ice-covered itself.

[2] For the definition of these terms see later p. 24.

[3] See the map fig. 1.

[4] In percentages: 5,6 p. c. high-arctic, 74 p. c. arctic and 20,4 p. c. subarctic—boreal, while the whole flora of the district in question (W II) has 1 p. c. high-arctic, 39 p. c. arctic and 60 p. c. subarctic—boreal, — thus a much less pronounced arctic character.

These evidences and the circumstance that so very many species occur high up in the mountains[1], seem to me to make it probable, that the hardiest part of the Greenland flora may have lived through the period of the maximum glaciation in the country itself. It is impossible to decide exactly the number of species, any more than what species we are dealing with, but they must first and foremost be looked for among the high-arctic and the widely distributed arctic species and I suggest that the number of such glacial species in Greenland amounts to about 60. But the problem can only be dealt with in its general aspects, not numerically, and it only comes to play a small part in the understanding of the origin of the Greenland flora, the more so, as it is more difficult to explain the immigration into Greenland of the less hardy species, which, besides, are the most numerous. In the subsequent attempt at unravelling the problem of the origin of the Greenland flora I have consequently been obliged partly to ignore the part played by this glacial (or pre-glacial) element.

IV. Plants from the Days of the Norse Colonisation.

It is a well-known fact that the ancient Norsemen had two fairly large and flourishing colonies in the southern part of West Greenland. This colonisation lasted between 400 and 500 years (from A. D. 985 — or 986 — to beyond the middle of the 15th century). Investigations of the ruins of the old settlements have shown, especially through the works of Daniel Bruun, that the larger, southern territory (Eystri byggd) embraced the area from the southern

[1] See the records of altitude by L. Kolderup Rosenvinge, Medd. Grønl. III, 3, 1892.

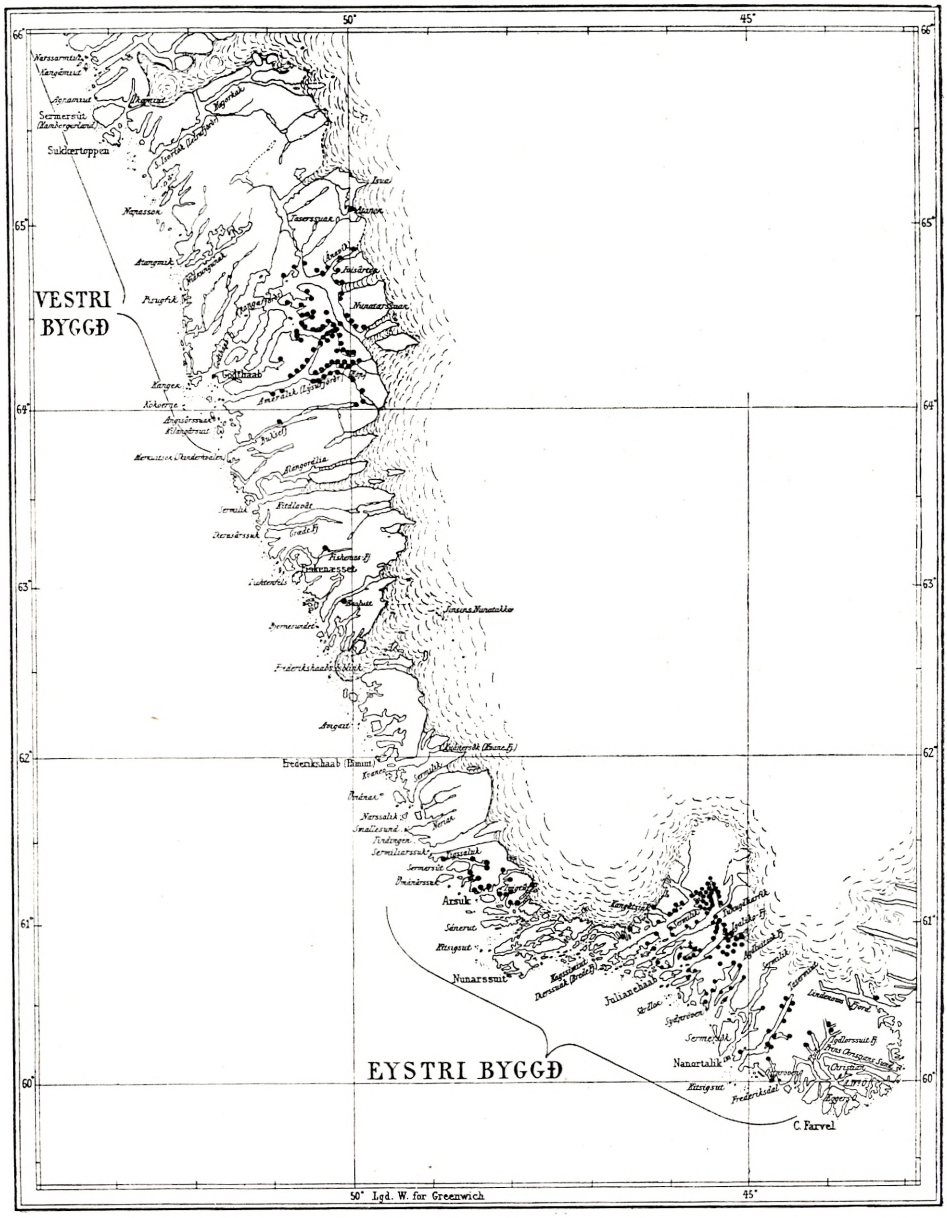

Fig. 1. Map of south-western Greenland showing the old Norse colonies; each dot represents the place of a farm. (From Medd. Grønland, vol. LXI).

extremity of Greenland to abt. 61°30′ N. Lat. on the West Coast, especially the inner fjord-districts. The northern colony (Vestri byggd) was mainly at Ameralik and Godthaab Fjord, abt. 64°—64°50′ N. Lat. (see fig. 1). Between these two, practically no ruins have been found. This colonisation was undoubtedly of great importance to the composition of the flora in these parts of Greenland, and it will, therefore, be interesting to endeavour to ascertain which species of the present flora of Greenland may be assumed to have been introduced through the medium of these ancient colonists.

The old sagas are remarkably deficient in details as to what the ancient sailors (vikings) took with them on their ships as food for man and beast. We do know, however, that the voyagers had live cattle and sheep on board; but as FRIDTJOF NANSEN in his book "Nord i Tåkeheimen" (1911) rightly says, we known very little as to how they provisioned themselves for their long voyages. They had probably corn (flour), salt meat, and the live cattle and sheep to furnish milk and meat. These animals would naturally have to be fed themselves with hay, whence we may conclude that the ships would carry considerable quantities of this. When the ships arrived at their destination, they would probably be taken ashore for the winter and cleaned, and the refuse of the hay fodder might then find its way to land. This again involves the possibility of seeds being carried to some place where they might germinate and grow. Moreover, this hay refuse must be regarded as consisting of very mixed material, since fields were not then sown with one or a few species of grass for hay, — in Iceland, and some parts of Norway, it is hardly done even to this day. And it was these two

countries, which did most of the traffic with the Greenland colonies, thus also supplying the hay and plant seeds as well.

But the cattle and sheep taken on board at the beginning of the outward voyage were not intended only to serve as food on the voyage; they were also kept on shore in Greenland. The breeding of cattle (cows and sheep) was, as shown in detail by Finnur Jónsson (1893), an important means of livelihood for the Norsemen in Greenland. "Kongespejlet" [The King's Mirror] also states that "much butter and cheese is made". The ruins found also show that the garths, or homesteads, were surrounded by fenced yards (tun) as in Iceland.

Altogether then, there are many indirect proofs that there was abundant opportunity of plant seeds being introduced from Europe (especially Iceland and Norway) into Greenland, and there are in the present flora several species (e. g. *Vicia cracca*) which have kept strictly to the neighbourhood of the old homesteads, especially at Igaliko, the old Bishop's Hall of Gardar. It has often been pointed out that these few plants owe their presence in the country to the ancient colonisation, and of this there can be no doubt. It is more difficult to decide in the case of species which found themselves more at home in Greenland, and have, in the intervening centuries, been able to spread and fuse with the original vegetation; in such instances, we can only form more or less warranted suppositions.

The possible "old Norse plants" should preferably show a range of distribution answering to the areas of the old colonies, which are now, as above noted, well defined (Daniel Bruun). Furthermore, they must be species living in Iceland or Norway, and finally, should preferably occur

in habitats which might be supposed to produce hay, i. e. meadows and grassy slopes. As will be seen from the accompanying list[1] there are about 50 species of flowering plants which can be said to fulfil these conditions fairly well; that is to say, as regards their distribution, that they are, on the whole, only found within an area reaching from the northern part of the Godthaab Fjord in the north to Lindenow Fjord in the extreme southern part of the east coast in the south — answering to the phyto-geographical districts W. III, W. II and I mentioned below (see also General List). Most of these are meadow- or grassland plants, and no fewer than 20 are grasses or grass-like plants. The majority are found only in District I, answering to the ancient southern settlement (Eystri byggd) and several of them which extend farther north are lacking in W. II, only to reappear in W. III, Godthaab Fjord, the ancient Vestri byggd.

We may thus reckon, with some degree of probability, that one-eighth (abt. 13 p.c.) of Greenland's 390 species of vascular plants were brought into the country through the old Norse colonisation.

List of Plants probably introduced by the Norsemen, — i. e. species almost exclusively found within the area of the old Norse colonies, and at the same time also found in Norway or Iceland, the majority in both these countries[2]:

E. Betula pubescens, N. Lat. 61°35 — 60°10.
G. Cerastium cæspitosum, 61°45 — 60°.

[1] I have not here included vascular cryptogams, even where they have the corresponding distribution, as their small and light spores enable them to be scattered by the wind for great distances, and they might thus equally well be supposed to have come to Greenland from overseas.

[2] For the meaning of capital letters prefixed to names of species, see p. 24.

G. Sagina nodosa, 61°21 — 61°2.
G. — procumbens, c. 61° — 60° — 61°.
E. Stellaria media, (67°), 62° — 60° —61°.
G. Atriplex sp. (longipes?), 60°27.
E. Capsella bursa pastoris, (65°), 61° — 60°.
G. Drosera rotundifolia, c. 61°.
E. Geranium silvaticum, 61°53.
G. (?)Epilobium palustre, (69°15, Disko), 64°54 — 60°.
G. Lathyrus maritimus, 61° — 60° — 60°30.
G. Vicia cracca, c. 61°.
E. Rumex acetosa, 62° — 60°.
E. — domesticus, 61° — 60°.
D. (?)Rubus chamæmorus, 64°15 — 60°43.
E. — saxatilis, 60°15° — 60°10.
G. (?)Haloscias scoticum, 64°25 — 60°.
E. Viola canina s. l, 61°30 — 60°.
G. Erigeron borealis, c. 65° — 60° — 62°.
G. Achillea millefolium, 64°10, 61° — 60°.
G. Gnaphalium uliginosum, 61°5 — 60°55.
H. Hieracium livido-rubens, 61° — 60°
H. — rigorosum, 61°25 — 60°.
H.[1]) — groenlandicum, c. 69°20 — 60° — 66°.
H. — hyparcticum, c. 67° — 60° — 66°.
E. Leontodon autumnale, 61° — 60°40.
G. Matricaria inodora grandiflora, 61° — 60°.
D. Galium triflorum, 63°4 — 60°27.
G. Rhinanthus groenlandicus, 63°10 — 60° — 61°.
G. Carex Goodenoughii, 61° — 60°.
E. — Lyngbyei, 61° — 60°.
G. — Oederi, c. 61°.
E. — panicea, 62° — 60°.
D. — polygama, 61°10.
G. — rostrata, 61° — 60°.
D. (?) — stylosa, 62° — 60° — 60°30.
G. Heleocharis uniglumis, c. 61°.

[1] A species of *Hieracium* which seems to agree very well with *H. groenlandicum* has quite recently (1925) been found in New Foundland, according to verbal information by Prof. M. L. Fernald to whom I am further indebted for important communications concerning the occurrence in North America of several other species.

G. Scirpus pauciflorus, 61° — 60°30.
G. Agrostis alba, 61°10 — 60°.
E. Anthoxanthum odoratum, 61° — 60°40.
E. Nardus strictus, 60°30 — 60°.
E. Poa annua, 62° — 60°.
G. — nemoralis, c. 61°10 — 60° (— 66°?).
G. Puccinellia maritima, 61° — 60°.
G. Juncus bufonius, c. 61°.
G. — filiformis, 61° — 60°.
G. — nodulosus, c. 61°.
E. — squarrosus, 60°30 — 60° — 60°30.
G. Luzula multiflora, 61° — 60° — 60°10.
G. Zostera marina, 64°30.

Notes to List above: *Epilobium palustre* has been found, outside the Norsemen's area, at South Disko, whither it might very well have been carried from South Greenland by the wind.

Rubus chamæmorus may perhaps also have been brought by birds from Arctic N. America.

R. saxatilis, which is common in Iceland and Norway, but lacking in North America, can hardly have been introduced by other means than by the Norsemen.

Of the *Hieracium* species, two extend beyond the Norse area, but as all are endemic (compare foot note on p. 18), and closely related to European species (see also p. 35) I reckon them all 4 as old Norse plants.

Zostera marina, only found in an inner arm of the Godthaab Fjord, and fairly frequent in Icelandic, frequent in Norwegian waters, and in America from the Strait of Belle Isle southwards, I consider to have most probably been brought by a ship in some way or other. Another supposition is that it is a survival from the post-glacial heat period (see p. 47); its occurrence in the innermost part of the fjord, where the water is unusually warm, seems rather to suggest this.

Some further species might perhaps have been added or interchanged with those noted; but the result would still be about the same.

V. Phyto-geographical Districts, and Distribution of the Species into Phyto-geographical Groups.

In the two previous sections, I have endeavoured to show it as likely that, in the first place, part of the flora of Greenland has survived the maximum of the glacial period in the country itself, though probably for the most part in its southern portions; and further, that another part of the flora must have been introduced by human agency during the occupation of the country by the Norsemen in the Middle Ages. The remainder — the greater part — of the flora must be presumed to have immigrated by the aid of Nature since the glacial period. The manner in which this immigration took place will be subjected to investigation in the following pages, but since it is, as already noted, impossible to distinguish with certainty the species of the glacial element, and as, moreover, any definition of the "Norse" element must necessarily be arbitrary in itself, I consider it most impartial to include all the 390 species of Greenland in the following observations. Special attention will, however, be drawn to those species which should presumably be reckoned as belonging to the Norse element, as well as those which I consider glacial.

As already mentioned, it becomes necessary to divide this great country into different sections, or districts, from north to south, both on the east and the west coast. It is of course more or less a matter of individual judgement, how many divisions are to be made: to my mind, however, our knowledge of the distribution of species is not sufficiently detailed to warrant subdivision into smaller sections than those I have made use of, where the size of each district varies from a little over one to abt. five degrees of latitude. The approximate boundaries of the districts,

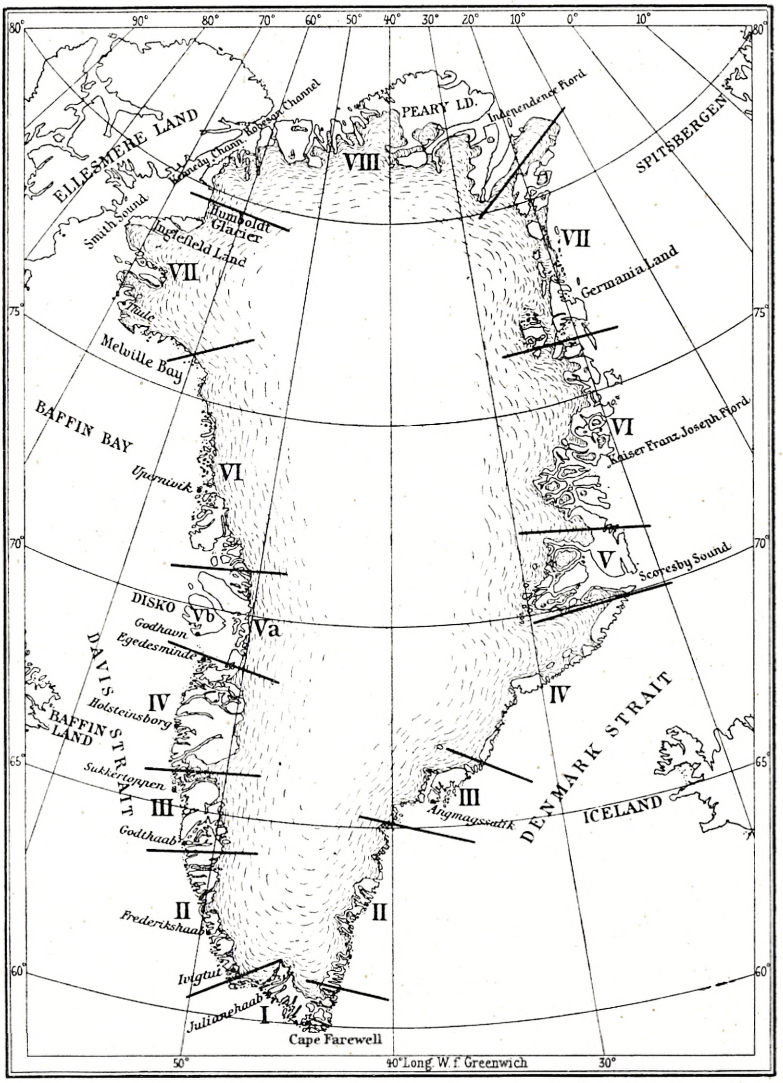

Fig. 2. Map of Greenland showing the phyto-geographical Districts.

noted in degrees of latitude, will be found in the accompanying Table I, and are also indicated on the small map of Greenland (Fig. 2). It will be seen that I have one district (VIII) for the northernmost and one (I) for the

Table I.

Phyto-geographical Districts of Greenland.

West.			East.	
	83° — 80°	VIII	83° — 81°.	
VII.	80° — 76°		81° — 76°	VII.
VI.	76° — 71°		76° — 72°	VI.
V a.	71° — 69°		72° — 69° 30.	V.
V b.	Disko		Scoresby S.	V.
VI.	69° — 66°		69° 30 — 67°	IV.
III.	66° — 64°		67° — 65°	III
			Angmagsalik	III
II.	64° — 61°		65° — 61°	II.
	61° — 60°	I	61° — 60°.	

southernmost parts of Greenland, while between these, there are 6 districts on the East Coast (E VII—E II) and 7 on the West Coast (W VII—W II), the island of Disko (Vb) being taken by itself as distinct from the corresponding portion of the mainland (Va); this is due to the fact that the southern portion of the island shelters a number of southerly species which are lacking on the mainland.

I have noted for each district:

1. No. of species,[1] and then divided them
2. according to their geographical occurrence outside Greenland, and
3. according to the phyto-geographical types to which this distribution refers them; also noting
4. how many of the species of a district are found only in West Greenland (for the West Coast districts) and in East Greenland (for the East Coast districts)

[1] For some of the districts (E II and E IV) in the southern part of the east coast I have included a small number of species that are not actually recorded from there, but occur both to the north and south of them, and so, in all probability, are to be found in the districts also, these having not been very thoroughly investigated and also forming very poor habitats for plants, inter alia, on account of the limited ice-free area.

Table II.

	N.	West Greenland							S.	East Greenland						N.	Whole Greenl.
Distr.	VIII	VII	VI	Va	Vb	IV	III	II	I	II	III	IV	V	VI	VII	VIII	
Group																	
A	10	18	17	25	26	30	28	24	24	9	8	6	11	10	8	10	53
B	1	1	1	1	2	1	2	2	2	2	2	1	1	1	1	1	2
C	14	14	15	18	15	10	4	2	2	..	2	4	14	18	13	14	26
D	18	20	30	34	38	36	29	23	22	10	17	18	33	27	18	18	56
E	..	1	1	4	4	9	7	15	24	8	10	3	6	2	2	..	32
F	2	1	1	1	1	..	..	..	..	..	..	..	3	2	1	2	4
G	30	57	90	121	140	155	159	161	184	137	140	97	101	71	53	30	209
H	2	2	..	2	3	4	4	5	5	2	2	..	..	..	1	2	8
Sum	77	114	155	206	229	245	233	232	263	168	181	129	169	131	97	77	390
A_1	44	52	41	43	37	28	9	2	2	..	9	16	39	45	41	44	58
A_2	30	51	94	113	116	114	106	90	85	80	89	85	104	70	49	30	130
S	3	11	20	50	76	103	118	140	176	88	83	28	26	16	7	3	202
W. Grl. only	..	9	8	24	32	48	45	52	87	..	..	..	..	..	..	..	134
E. Grl. only	..	..	..	..	..	..	..	..	..	..	3	1	6	5	2	..	9
Reaching Distr. I	32	52	93	122	155	172	192	209	263	166	161	102	103	70	49	32	..

5. and how many extend right down to the southernmost district (I).

All these data are summarised in Table II; reference should also, however, be made to the General List at the end of the paper.

The distribution in regard to geographical occurrence outside Greenland is based on floras of North America, Iceland, Scandinavia, Spitsbergen and other arctic islands north of Europe, the remaining portions of Europe, etc. A species is always ascribed to whatever category brings

it nearest to Greenland. If it is found for instance, in Arctic North America and Arctic Asia, it is taken as American, while a species occurring in Europe, possibly in Iceland, and also in western North America, is regarded as European. The categories employed are as follows:

A. Species found in North America, but not in Europe.
B. Species found in North America and Iceland, but not in other parts of Europe.
C. Species found in North America and Europe, but not in Iceland and Scandinavia.
D. Species found in North America, and in Europe, but not in Iceland.
E. Species found in Europe, but not in eastern North America.
F. Species found in arctic Europe, but not in Scandinavia and Iceland, nor in N. America.
G. Species found in North America, Iceland and Europe (circumpolar species).
H. Species not known outside Greenland (endemic species).

Following the general geographical distribution of the species, I have thereupon divided them into three phytogeographical types (elements). This must of course always be done according to the writer's personal judgement, as there will inevitably be some doubtful cases. I have chosen to divide as follows:

A_1. High-arctic species, i. e. those found almost exclusively in arctic regions and able to thrive under very severe conditions.

A_2. Arctic species, i. e. those having their main area of distribution in the arctic regions, but also found far outside these.

S. Sub-arctic and boreal species, i. e. those having their main area of distribution outside (south of) the arctic regions; some of these get along very well in the arctic regions (which is probably connected with the fact that they consist, properly speaking, of several minor specific units); others are found only on the most favourable sites of Greenland. For the purpose of our present task, this type, properly consisting of several, may be taken as one, and can also be termed the "southern element". (PORSILD, for instance, uses this term).

We shall now, in the following pages, show what can be deduced from Table II in regard to the distribution of the flora in Greenland according to districts; to their alterations with latitude; indications as to manner of immigration, etc.

VI. The Abundance of Species on the West Coast.

Table II shows convincingly that the West Coast of Greenland is far richer in number of species than the East Coast. The South District (I) which, as will be noted, also extends a short distance along the east coast, contains the greatest number of species of any district, viz. 263. This is due to several causes. Firstly, its southerly situation, and further, the relatively large extent of ice-free country, with long and sheltered fjords, and finally, the ancient Norse colonisation. No fewer than 46 out of the 50 plants or thereabout noted on pp. 17—19 as introduced by the Norsemen, are found in this district. Proceeding from this south district northward along the west coast, the number of species decreases fairly regularly, though the number in W. IV

(245) is greater than that in W. III and that in W. II, which is taken in connection with similarly favourable conditions for growth of vegetation to those prevailing in District I, viz., much ice-free land and deep fjords. Making allowance for the Norse colonisation, and subtracting its species, W. IV becomes, indeed, the richest district of the West Coast, as will be seen from the following

Table III.

Districts (W)	Vb	IV	III	II	I
Whole Flora	229	245	233	232	263
Old Norse plants	2	3	10	23	46
Flora excl. Norse plants	227	242	223	209	217

That W. II, after subtracting the Norse plants, becomes so poor in species, is explained by the fact that the northern part of the Norse settlement "Eystri byggd" lay just inside the southern boundary of the district, and at any rate 10 of the 23 Norse plants are found only in that small area, while the remaining portion of the district is not large in extent and has very little ice-free land.

Table II also shows the abundance of species on Disko island. As already mentioned, a number of southerly species are found in the southern part of Disko, but do not go so far north on the mainland. The peculiar conditions obtaining on the island have been touched on several times by M. P. Porsild, from whose hand a detailed description of the flora and vegetation of this island may be looked for.[1]

The northerly districts on the West Coast also stand

[1] The flora (but not the general result of plant distribution) has now been published: Porsild, M. P. and A. E., The Flora of Disko Island etc. (in Medd. Grønl. LVIII, 1926).

out with a greater abundance of species than the corresponding districts on the eastern side. A peculiarity of the northerly western districts is their relatively slight distance from Ellesmere Land (Grant Land), whence species might easily find their way.

It is thus a generally characteristic feature, that the flora of the West Coast is richer in number of species than that of the East Coast, and the explanation is the same as that mentioned in the case of the specially rich districts: more ice-free land, more sheltered situation and shorter distance from other countries; also the part played by the Norse colonisation. Altogether, 134 species have been found on the West Coast which are not found on the East Coast (north of District I), that is, about one-third of the whole flora[1]. Of these, as mentioned, abt. 50 are Norse Plants, but the remainder, abt. 84, immigrated by the aid of Nature. This figure may, however, be somewhat reduced, as we may assume that some few inconspicuous or critical species not at present known from East Greenland, will later be found there, e. g. *Sagina cæspitosa*, some *Carex* species, *Callitriche* and *Potamogeton* species and other water plants.

There is indeed a conspicuous lack of aquatic plants in East Greenland, which can only be partly explained by the fact that there are fewer fresh waters than in West Greenland; the low figures will doubtless be partly due also to insufficiency of investigations here. There are 26 species of aquatic plants known from Greenland, and all these are found in West Greenland; only 7 or 8 of them have also been found in East Greenland (all in the Angmagsalik District; of these, 3 also occur elsewhere in East Greenland).

[1] These are marked W on the General List.

Among other remarkable features in the peculiar abundance of the West Coast it may be mentioned that out of the 14 *Ericaceæ (sens. lat.)* found in Greenland, half are found only in West Greenland, viz. *Andromeda glaucophylla, A. polifolia, Arctostaphylos uva ursi, Ledum decumbens, L. groenlandicum, Oxycoccus* and *Vaccinium vitis idæa.* All must be presumed to have come from N. America. Something similar is found in the case of the genus *Pedicularis* which in West Greenland comprises 8 species, whereof only 3 (*P. flammea, P. hirsuta* and *P. lapponica)* are also found in East Greenland; here also the remaining 5 species are of American origin.

It is of course only natural that the species peculiar to the West Coast should, outside Greenland, be sought in N. America, and this also proves to be the case with nearly all of them; there are, however, two species (the Norse plants have already been mentioned) which are known from Europe (Scandinavia, but not Iceland), but not yet found in North America; these are: *Carex holostoma* and *C. rufina.* Both are inconspicuous and not very characteristic; it is likely therefore that they will in course of time be discovered both on the East Coast and in N. America.

Among the species which have immigrated to West Greenland from N. America we have first of all a contingent of southerly species, e. g. *Streptopus amplexifolius, Orchis rotundifolia, Sorbus decora, Alnus crispa, Cornus canadensis, Viola Selkirkii* and *Anemone Richardsonii*; then come a few common arctic species, such as *Artemisia borealis, Ledum decumbens, Primula farinosa groenlandica, Pedicularis lanata*; and finally a third batch, consisting of high-arctic species,

e. g. *Hesperis Pallasii, Pedicularis arctica, P. capitata, Carex aquatilis stans, Taraxacum hyparcticum, T. pumilum* and *Potentilla Vahliana.*

VII. The Paucity of Species on the East Coast.

That this paucity of species on the East Coast is more particularly due to unfavourable external conditions seems quite evident, when we look at the tables for the individual districts: E. II and E. IV, which have but little ice-free land and no deep fjords, are especially poor. The low values are perhaps due in some degree to the fact that these districts have been but inadequately explored; this, however, I have endeavoured to make up for by "interpolating" — see p. 22 footnote, — some common species not recorded from there, but which, being found both to the north and south, and not particular in their choice of habitat, may nevertheless be supposed to occur there.

In contrast to these two poor districts we have E. III (Angmagsalik) and E. V (Scoresby Sound) where conditions are far more favourable; here, we find 181 and 169 species respectively; and it must be borne in mind also that, on the East Coast, we have not to reckon with the old Norse element. Two European species found in the Angmagsalik district are not known anywhere else in Greenland, viz: *Sedum acre* and *Alchimilla acutidens*; these must be supposed to have immigrated directly from Iceland, where they are common.

As regards Scoresby Sound, it is remarkable that some species are found only on the inner branches of the fjord, i. e. as far as possible from the rainy and misty coast with the great belt of drift-ice outside. Two of these species are

of American origin, found on the West Coast and here, but nowhere else on the East Coast, viz. *Arabis Holboellii* and *Dryopteris fragrans*; two other American species also have, so to speak, jumped from the West Coast to this district, viz. *Arabis arenicola* and *Saxifraga tricuspidata*. These 4 American species should most naturally be supposed to have been carried across the inland ice, the seed-bearing portions having been swept over the surface of the ice by storms. We have then some species of eastern origin: *Braya glabella*, *Carex parallela* and *Saxifraga hieraciifolia*, which belong specifically to the East Coast, and some more southerly species such as *Alchimilla glomerulans*, *Taraxacum brachyceras*, *Carex alpina* and *microglochin*, *Hieracium alpinum* and others.

The district north of Scoresby Sound (E. VI) is, it is true, rather poor in species, but the deep fjords do provide some sheltered sites, and it is only with District E. VII that the true high-arctic poverty is distinctly apparent.

The harshness of the climate on the East Coast is undoubtedly due to the ice masses of the mighty East Greenland polar current; we have here a striking contrast to the conditions prevailing on the West Coast.

Altogether, the East Coast has only 9 species peculiar to itself, as against the 134 of the western side. These are: *Sedum acre* and *Alchimilla acutidens*, already noted, and *Arenaria ciliata pseudo-frigida*, *Braya glabella*, *Draba repens*, *Saxifraga hieraciifolia*, *Polemonium boreale*, *Ranunculus glacialis* and *Carex parallela*. The last seven, of which 3 have been mentioned under Scoresby Sound, are arctic species, and of these, only *Ran. glacialis* is found in Iceland; this, like the remaining six, may most naturally be supposed to have been brought from the north-east by the East Green-

land polar current. *Drapa repens* is not found nearer than Novaya Zemlya; the others are found in arctic Europe (including the islands to the north).

VIII. North Greenland (North of 76° N. Lat.).

That part of Greenland which lies north of abt. 76°N. Lat. forms, especially as regards the West Coast, a section with a character of its own. I call this part North Greenland, and it includes the North Coast District (VIII), with the adjacent districts on the West Coast (W. VII.) and on the East Coast (E. VII.). In a previous paper (Ostenfeld 1923) I have considered in more detail the flora of this part of Greenland, which is the poorest of all as regards number of species, and the one which offers the severest conditions for plant life. We find here in all 125 species, of which 77 are found on the north coast itself, the poor flora of which is well known, thanks to the careful collections made by the late Dr. Th. Wulff.

The paucity of species is due to the fact that quite a large number both from the West and East Coast stop at the barriers formed by the inland ice, the big glaciers of which run right out into the sea at 76°—75° N. Lat. On the other hand, there are 8 species not found elsewhere in Greenland. These are naturally high-arctic species, and must be supposed to have immigrated from the west, via Ellesmere Land. Two of them, *Minuartia Rossii* and *Braya Thorild-Wulffii*, have found their way northward round Greenland and down the East Coast to abt. 76° N. Lat. The remaining 6 do not go further than the North Coast, these are: *Hesperis Pallasii, Ranunculus Sabinei, Taraxacum hyparcticum, T. pumilum, Pedicularis arctica* and *P. capitata*. Of these, the two *Pedicularis* species have only managed to

cross the narrow Smith Sound to Inglefield Land, but have not as yet extended farther. *Minuartia Rossii* and *Hesperis Pallasii* are found not only in arctic America, but also in the arctic islands north of Europe; it is, however, most natural to suppose that they have immigrated from the west.

IX. Relation between the three phyto-geographical Elements in the different Districts.

In Table II, the species are also divided into three phyto-geographical elements: high-arctic (A_1), arctic in the wider sense (A_2), and sub-arctic and boreal (S), and the number of species in these three categories is stated for each district.

The absolute figures themselves reveal an interesting regularity; this is, however, even more clearly apparent when we work out the percentages as seen in the accompanying Table IV and the curves of the graph Fig. 3.

Table IV.

Percentages of the 3 phyto-geographical elements in the various districts.

	West							South				East				
	VIII	VII	VI	Va	Vb	IV	III	II	I	II	III	IV	V	VI	VII	VIII
A_1...	**57**	46	26	21	16	11	4	1	1	0	5	12	23	34	42	**57**
A_2...	39	45	**61**	**55**	51	47	45	39	32	48	49	**66**	**62**	54	51	39
S ...	4	9	13	24	33	42	51	**60**	**67**	52	46	22	15	12	7	4

A_1. High-arctic. A_2. Arctic *sens. lat.* S. Sub-arctic and boreal.

It will be noticed that the number of high-arctic species, which amounts to 57 p. c. of the total no. of species in District VIII, falls evenly to 1 p. c. in District I (District E II

has indeed 0 p.c., but this is doubtless due to the above noted poverty of this district), and that the subarctic-boreal species rise from 4 p.c. in District VIII to 67 p.C. in District I. This is what we should expect to find. An interesting feature is that of the percentages for the common and widely distributed arctic species (A_2); these are most numerous in Distr. W. VI and Va, and in E. IV and V,

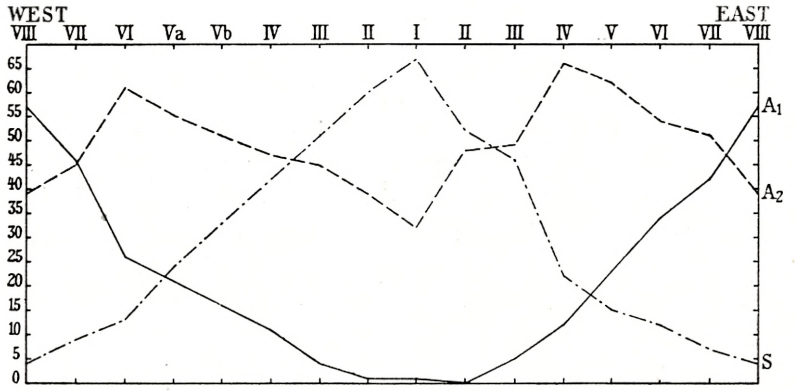

Fig. 3. Curves shoving the percentages of the 3 phyto-geographical elements in the various districts.

where we have thus conditions specially favourable for them; the number falls from these two maxima both to the south, where the minimum is reached in District I (32 p.c.), and to the north, with minimum in Distr. VIII (39 p.c.). This mode of distribution suggests that they are correctly estimated as arctic species in a wider sense, as compared with the true high-arctic on the one hand and the subarctic and boreal on the other.

X. Endemic Species.

In earlier times, a number of species were described from Greenland as not known elsewhere. Most of these

have since been either discovered in other countries, or are included under other species, hardly any remaining as endemic to Greenland.

On the other hand, some few new ones have been added, as the flora of the country became more thoroughly investigated. These belong to the so-called critical genera, and several of them will probably in the course of time also be discovered in adjacent countries.

Among easily recognisable species, *Melandryum triflorum* was long regarded as endemic to Greenland, which was very remarkable, as it is a species very widely distributed in Greenland itself, ranging from the North Coast to abt. 67° on the West Coast and abt. 72° N. Lat. on the East. It was several times recorded from arctic America, but closer investigation always showed that the determinations were erroneous.

Now however, it appears after all, as first pointed out, I think, by M. P. Porsild, that a plant from the mouth of the Mackenzie River, described as *Lychnis triflora* var. *Dawsoni* B. L. Robins., is the same as *M. triflorum*; and this, after having seen the original specimen, I can myself confirm. This remarkable instance of endemism was thus disposed of. It is nevertheless rather surprising that the species has not hitherto been found elsewhere in the wide expanse of arctic America.

The number of endemic species is at present 8, viz.:

Braya Thorild-Wulffii, Taraxacum arctogenum, Potamogeton groenlandicus, Antennaria intermedia.

Hieracium groenlandicum, H. hyparcticum, H. livido-rubens and *H. rigorosum.*

It would further seem, from collections made in 1925 by M. P. Porsild, that closer investigation of the *Taraxaca*

and *Hieracia* from the most southern parts will probably add to the number of endemic species in these two genera.

As a rule, endemic species offer little of interest in phyto-geographical respects; with some of those here mentioned, however, it is otherwise. Of little value in this respect is *Braya Thorild-Wulffii*, a high-arctic species, closely allied to the widely distributed *B. purpurascens*; it will probably also be found in the adjoining parts of arctic America. *Potamogeton groenlandicus* is a little known species, which has only been found as sterile, and has been described from anatomical features (HAGSTRÖM 1916); it is related to *P. mucronatus* (*P. Friesii*). and may also perhaps occur in arctic America.

The other endemic species belong to 3 genera, all of which are peculiar by the fact that their sex conditions are abnormal; a large number of the species, including all the arctic ones (as far as known), are apogamous (i. e. form seeds without fertilisation), so that any new micro-species arising is at once fixed, and cannot be effaced by crossing back with the parent species. Of these endemic species, there is no special reason to dwell on *T. arctogenum* and *Antennaria intermedia*; the 4 *Hieracium* species on the other hand, are of particular interest as belonging to sections within the genus not found in arctic America at all.[1] And since they are also mainly found within the region formerly occupied by the Norsemen, it seems most likely that they are descendants of *Hieracia*

[1] Since this was written Professor M. L. FERNALD has kindly informed me that in 1925 he found a *Hieracium* on north-western New Foundland which he cannot distinguish from *H. groenlandicum*. This interesting record may have a far-reaching influence on the theory put forward here, but I prefer at present to suppose that the New Foundland plant has arrived thither from Greenland, the achenes of *Hieracium* being well adapted to be carried by wind.

accidentally introduced by these colonists. That they have spread somewhat beyond the bounds of the original settlements (on the West Coast to Disko, and on the East to Angmagsalik) may be explained by their having achenes admirably adapted to be carried by the wind; they may thus have been transported over these distances in the course of the 500—900 years that have elapsed since their introduction.

Far more remarkable, however, is the fact that they have become endemic, being unknown at the present day either in Iceland or Norway, whence it must be presumed that their ancestors were brought. This can hardly be explained otherwise than by supposing that in the course of the intervening centuries, new species have taken the place of those originally brought over. — It is of course taken for granted that the specialists in the study of *Hieracia* are right in regarding them as distinct micro-species. — In the very first description given by S. Almquist (1884) mention is made of their close relationship to other species; it is stated, for instance, with regard to *H. rigorosum*, that "of Scandinavian species, *H. strictum* Fr. Lindeb. exs. no. 94 is closely related to this" and with regard to *H. groenlandicum*, that "among Scandinavian forms, *H. dovrense* Fr. *plicatum* Lindeb. is extremely closely akin". That new micro-species can arise among apogamous *Hieracia*, before our very eyes as it were, I have already shown by culture experiments (Ostenfeld 1921); the remarkable feature in the present case is, that the original forms seem to have disappeared. Whether this has taken place in Greenland alone, or also in Iceland — or Norway as the case may be — is of course not easy to determine.

It seems at any rate as if the Greenland *Archieracia* (apart from *H. alpinum L.*) have differentiated out since their

immigration in the days of the Norsemen, which gives a maximum age for these cases of endemism of abt. 900 years.

XI. Distribution of the Species throughout Greenland.

It is but natural, of course, that some species should be more widely distributed throughout Greenland than others. Those of widest range are the 32 species found from the North Coast right to the southern extremity. Between this and its opposite, viz. occurrence restricted to a single locality, we have all possible degrees of transition, as will be seen from the General List. The number of rare species, i. e. those found only in one or some few places, is very large. This is already apparent from the fact that a number of species are known from only one of the 15 districts. Richest in this respect is the South District, I, which has 36 species to itself. It is a far cry from this to W. II whith 6 species *(Sagina nodosa, Geranium silvaticum, Viola Selkirkii, Andromeda glaucophylla, Primula egalikensis* and *Carex polygama)*, W. IV with 5 *(Cerastium arvense, Braya humilis, Arctostaphylos uva ursi, Andromeda polifolia* and *Utricularia intermedia)*, W. III with 3 species *(Ranunculus cymbalaria, Arctophila fulva* and *Zostera marina)*, W. VII with 2 species (*Pedicularis arctica* and *P. capitata*), E. III with 2 *(Sedum acre* and *Alchimilla acutidens)*, E. V with 2 *(Draba repens* and *Carex parallela)*, E. VI with 1 *(Polemonium boreale)* and W. VIII with 1 *(Taraxacum pumilum)*. Generally speaking, we may take it that species with a narrow range of distribution are recent immigrants, while those widely distributed throughout the country have presumably been there for a longer time.

As will be further considered in the following, these immigrant species must be divided into those coming

from the West (American species) and those from the East (European species). In each category we find species with wide distribution and species of very restricted occurrence. Often however, the distribution in Greenland itself gives some indication as to the direction whence a species has come. We may generally say, for instance, that the American species are more widely distributed, and more numerous, on the West Coast than on the East. They may have found their way to the East Coast by the southward route via Cape Farewell; this I presume to be the case for instance with *Minuartia groenlandica*, *Draba aurea*, *Coptis trifolia*, *Potentilla tridentata*, *Antennaria groenlandica*, *Galium Brandegei*, *Carex deflexa* and *Habenaria hyperborea*, as also, for instance, with a good American species like *Carex scirpoidea*, though this also has been found in a single locality in Norway. All these have a marked northern limit of occurrence on the West Coast south of Melville Bay, but extend right down to the southern extremity, and can thence have proceeded without interruption northward along the East Coast. Others again may have come from the north; these include such species as *Melandryum triflorum*, *Lesquerella arctica*, *Potentilla Pedersenii*, *Erigeron compositus* (?), *Tofieldia coccinea*, *Deschampsia arctica* and *D. pumila*. These species have (practically) no northern limit in Greenland, but extend only some way down the East and West Coasts. (*Erigeron compositus* has a few records in the southernmost districts of the West Coast). I have already noted (p. 30) that 4 American species with both north and south limit of distribution in West Greenland are found again in the Scoresby Sound district on the East Coast, and must be presumed to have crossed the inland ice.

It is, however, by no means always that we can draw any conclusions as to their origin from the distribution of the species in the country; the European *Ranunculus acer* for instance, has precisely the same distribution in Greenland as the American *Coptis trifolia*.

Only a few species extend farther northward on the East Coast than on the West, which agrees with the fact that conditions of life are more severe on the east than on the west. Among the few exceptions we find, strangely enough, the circumpolar *Sedum roseum*, which is known on the East Coast up to abt. 74° N. Lat., while on the West Coast it only goes as far north as Lat. 69°. It is not easy to advance any explanation of this. It is easier to understand that three European "southerly" species, reach their farthest north on the East Coast, where they must be presumed to have made their first appearance in the country; *Hieracium alpinum* extends, on the East Coast, up into Scoresby Sound (abt. 71° N. Lat.), but on the West Coast only to abt. 62½° N. Lat. *Carex atrata* and *Agrostis canina* are both found in the Angmagsalik district on the East Coast, but go no farther than abt. 62° N. on the West Coast.

XII. Immigration into Greenland.

Table II shows the species grouped according to their distribution outside Greenland, there being 8 groups in all (A—H). Of these, the endemic group (H) has already been discussed, and it was suggested that the ancestors of the 4 species of *Hieracium* had presumably immigrated with the Norsemen[1]. The other "old Norse" plants have also been dealt with (pp. 13—19).

[1] The other 4 endemic species are most probably of American origin.

The great majority (209) of the species are comprised in Group G, the circumpolar species, and their distribution outside Greenland gives us no direct indication as to the route by which they found their way to Greenland. To these we shall return later on.

Groups A and B contain species which must have come from America. Group B consists of but 2 species *(Epilobium latifolium* and *Habenaria hyperborea)*, which are widely distributed in America and have again found their way from Greenland farther east, viz. to Iceland, but not to the continent of Europe; both have seeds easily carried by the wind. They are doubtless of as pronounced western origin as the 53 species of Group A:

Dryopteris fragrans.
Alnus crispa.
Betula glandulosa.
Callitriche anceps.
Melandryum triflorum.
Minuartia groenlandica.
Cornus canadensis.
Aralis arenicola.
— Holboellii.
— Hookeri.
Braya humilis.
Draba aurea.
Lesquerella arctica.
Anemone Richardsonii.
Coptis trifolia.
Ranunculus Sabinei.
Dryas integrifolia.
Potentilla Pedersenii.
— Ranunculus.
— tridentata.
— Vahliana.
Sorbus decora.
Salix chloroclados.
Salix uva ursi.
Parnassia Kotzebui.
Saxifraga tricuspidata.
Viola labradorica.
Antennaria groenlandica.
Artemisia borealis.
Erigeron compositus.
Taraxacum groenlandicum.
— hyparcticum.
— pumilum.
Andromeda glaucophylla.
Ledum groenlandicum.
— decumbens.
Pirola grandiflora.
Primula egalikensis.
— farinosa groenlandica.
Pedicularis arctica.
— capitata.
— euphrasioides.
— groenlandica.
Galium Brandegei.
Carex aquatilis stans.
— deflexa.

Carex gynocrates.
— pratensis.
Calamagrostis confinis.
Deschampsia arctica.
Deschampsia pumila.
Tofieldia coccinea.
Orchis rotundifolia.

Similarly, we may consider the species in Groups E and F as originating from the east (from Europe).

Group E (species found in Europe but not in America), contains 32 species:

N. Betula pubescens.
Arenaria ciliata pseudofrigida.
N. Stellaria media.
Sedum acre.
— annuum.
N. Capsella bursa pastoris.
N. Geranium silvaticum.
N. Rumex acetosa.
N. — domesticus.
Ranunculus acer.
— glacialis.
Alchimilla acutidens.
N. Rubus saxatilis.
Archangelica officinalis.
N. Viola canina s. l.
Hieracium alpinum.
N. Leontodon autumnalis.
Taraxacum brachyceras.
Thymus serpyllum var.
Veronica fruticans.
Utricularia ochroleuca.
Carex atrata.
— holostoma.
N. — Lyngbyei.
— parallela.
N. — panicea.
— rufina.
N. Anthoxanthum odoratum.
Deschampsia alpina.
N. Nardus strictus.
N. Poa annua.
N. Juncus squarrosus.

Of these 32, at least 15 were introduced by the Norsemen (N.) and should thus also for this reason be reckoned as immigrants from the east. Most of the others are also subarctic and boreal species, only a few, such as *Arenaria pseudofrigida* and *Ranunculus glacialis*, being arctic.

The little F group consists of 4 species, not found on the continent of Europe, but occurring on the arctic islands north of Europe; they must presumably have made their way into Greenland from the north-east:

Draba Adamsii	Epilobium arcticum
— repens	Taraxacum arcticum.

Of these, *Epilobium arcticum* has a remarkable area of distribution in Greenland, being found both on the West Coast at 72°—69° N. Lat., and on the East Coast in Scoresby Sound (abt. 71° N. Lat.). Another remarkable range of distribution is that of the circumpolar, but rare, *Carex atrofusca* (*C. ustulata*): West Greenl. Distr. VI and Va, East Greenl. Distr. V. The immigration of such species is difficult to understand; in the case of *Epilobium*, however, we must, as long as it is elsewhere only known from arctic Eurasia, regard it as coming from the east.

There remain two groups which must be considered more closely. Group C comprises 26 species, which are characterised by being found both in America and Europe, though not in those European countries which we should most naturally consider as likely sources of origin, viz. Iceland and Scandinavia. The species are as follows:

S Cerastium arvense.	A_1 Saxifraga flagellaris.
S Streptopus amplexifolius.	A_1 Taraxacum phymatocarpum.
S Carex supina.	A_2 Polemonium boreale.
S Draba stylaris.	A_2 Pedicularis lanata.
———	A_2 Carex ursina
A_1 Minuartia Rossii.	A_1 Alopecurus alpinus.
A_1 Draba subcapitata.	A_2 Arctophila fulva.
A_1 Eutrema Edwardsii.	A_1 Dupontia Fisheri.
A_1 Hesperis Pallasii.	A_1 Pleuropogon Sabinei.
A_1 Ranunculus affinis.	A_1 Poa abbreviata.
A_1 — sulphureus.	A_1 Puccinellia angustata.
A_1 Potentilla emarginata.	A_2 — tenella.
A_1 Potentilla pulchella.	A_1 — Vahliana.
A_1 Salix arctica s. l.	

Of these, the first 4 are sub-arctic and boreal, and it is thus natural that they should have come to Greenland

via America, since on the European side, we have to go right down into Central Europe, or still farther, to find them. The remainder are high-arctic (A_1) or arctic (A_2). Of these, *Polemonium boreale* is found only on the East Coast, and must presumably have come from the east, whereas *Hesperis*, *Pedicularis lanata*, *Arctophila* and *Puccinellia tenella* are found only on the West (and North) coast, and must naturally be supposed to have come from the west. We have, then, in Group C, 4 + 4 westerly species in all, and 1 easterly; the remainder are uncertain, and have probably to a great extent immigrated prior to the maximum of the ice age (glacial species).

Group D comprises those species which are found both in America and Europe (incl. Scandinavia), but are lacking in Iceland. These number no fewer than 56, as under:

I. Rubus chamæmorus.
Carex polygama.
— stylosa.
Galium triflorum.
II. Braya glabella.
Saxifraga hieraciifolia.
III. Equisetum scirpoides.
— silvaticum.
Sagina cæspitosa.
Ranunculus cymbalaria.
— lapponicus.
Viola Selkirkii.
Linnæa borealis s. l.
Andromeda polifolia.
Utricularia intermedia.
Calamagrostis Langsdorffii.
Vahlodea atropurpurea.
Luzula parviflora.
IV. Isoëtes lacustre s. l.
Botrychium boreale.
— simplex.
Cystopteris montana.
Lycopodium complanatum.
Asplenium viride.
V. Draba crassifolia.
Ranunculus nivalis.
Antennaria alp. glabrata.
Arctostaphylos alpina.
Rhododendron lapponicum.
Pedicularis lapponica.
Carex atrofusca.
— rotundata.
— scirpoidea.
Cobresia bipartita.
Agrostis borealis.
Calamagrostis arund. purpurascens.
Luzula frigida.
VI. Woodsia glabella.
Melandryum apetalum.
— pauciflorum.
Stellaria longipes.

Braya purpurascens.
Draba cinerea.
— Wahlenbergii.
Potentilla nivea.
Saxifraga stell. comosa.
Arnica alpina.
Erigeron eriocephalus.
Cassiope tetragona.
Pedicularis hirsuta.
Carex misandra.
Arctagrostis latifolia.
Hierochloe alpina.
Poa arctica.
Puccinellia phryganodes.
Luzula nivalis.

These species have here been divided into 6 sections, Section I (4) consists of old Norse plants (*C. stylosa* and *C. polygama*, however, are doubtful) and those of Section II (2) have only been found in the northern part of East Greenland. Section III (12 species) is restricted to West Greenland; it is likely therefore that these plants came from the west. Section IV (6 species) consists exclusively of vascular cryptogams only found in the southern district; these must also probably be regarded as originating from the west, making 18 species in all. Section V (13 species) consists of widely distributed arctic species found both in West and East Greenland; all have a distinct northern limit of occurrence in Greenland, and most of them also a southern. Two of them (*Carex scirpoidea* and *Calamagrostis arund. purpurascens*) are otherwise found almost exclusively in arctic America, and are very rare in Eurasia, and must thus be regarded as immigrants from the west; as to the remainder (11) nothing can be said. Finally, we have Section VI consisting of (19) high-arctic species nearly all found in the northernmost part of Greenland, and all with a southern limit of occurrence somewhere on the coast both on the eastern and western sides. Their immigration route cannot be stated; they are most probably older than the maximum of the ice age. Thus for Group D: 6 eastern, 20 western and 30 uncertain (of which 19 presumably glacial).

The circumpolar species (Group G) number no fewer than 209. Of these, a considerable number occur only in West Greenland, and in the case of these it is natural to regard them as of western origin. There are 26 species in all:

Equisetum hiemale.
Isoëtes echinosporum s. l.
Lycopodium clavatum.
Athyrium alpestre.
Dryopteris dilatata.
— filix mas.
Selaginella selaginoides.
Callitriche autumnalis.
Arenaria cil. norvegica[1].
Cornus suecica[2].
Radicula islandica.
Myriophyllum alterniflorum.
— spicatum, var.
Arctostaphylos uva ursi.
Vaccinium vitis idæa.
Lomatogonium rotatum.
Menyanthes trifoliata.
Utricularia minor.
Heleocharis acicularis.
Agropyrum violaceum.
Catabrosa aquatica.
Coralliorhiza trifida.
Listera cordata.
Potamogeton alpinus.
— gramineus.
Sparganium hyperboreum.

Several of these occur as distinct varieties, corresponding to those found in North America. With the exception of *Arenaria norvegica* (*cylindrocarpa* Fernald), they are all "southerly" species, and there are comparatively many aquatic plants among them.

Of the 183 species remaining, 27 are old Norse plants, leaving 156, of which again I consider 26 as possibly glacial species, i. e. dating from before the glacial maximum in Greenland, viz:

Equisetum arvense.
— variegatum.
Lycopodium selago.
Cerastium alpinum.
Minuartia rubella.
Sagina intermedia.
Silene acaulis.
Cardamine bellidifolia.
Cochlearia officinalis s. l.
Draba alpina.

[1] Probably the American subspecies *cylindrocarpa* Fernald.
[2] Also on the southernmost part of the East Coast.

Papaver nudicaule.
Oxyria digyna.
Polygonum viviparum.
Saxifraga cernua.
— groenlandica.
— nivalis.
— oppositifolia.
Armeria vulgaris. s. l.
Carex nardina.
Eriophorum polystachyum.
— Scheuchzeri.
Catabrosa algida.
Festuca ovina, var.
Poa glauca.
Juncus biglumis.
Luzula confusa.

With regard to the rest, it cannot be said with certainty whether they came from the west or from the east.

Summing up the foregoing observations, we arrive at the following:

Table V.

Number of species	Total	American Origin	European Origin	Of which Old Norse Plants	Uncertain Origin	Of which probably glacial
Group H.....	8	4	4	4	..	..
— B.....	2	2	..	..	..	..
— A.....	53	53	..	..	..	..
— E.....	32	..	32	15	..	..
— F.....	4	..	4	..	..	..
— C.....	26	8	1	..	17	17
— D	56	20	6	4	30	19
— G.....	209	26	27	27	156	26
Total...	390	113	74	50	203	62
Percentage...	100	29	19	(12,8)	52	(16)
Total excl. Old Norse Plants	340	113	24	..	203	..
Percentage...	100	33	7	..	60	..

We have thus 113 species (29 p.c. of the flora) probably of western origin, 74 species (19 p.c). probably eastern, while of the latter I regard 50 as probably brought in by

the Norse Colonisation, leaving only 24 as brought by Nature, which alters the percentage to 33 p. c. western and 7 p. c. eastern. The figure 113 is doubtless a minimum value for the immigrants from the west, as it is natural to suppose that out of the 203 "uncertain", i. e. whose distribution outside Greenland might bring them either from east or west, most should have come from the west, since America is much nearer, and the West Coast of Greenland offers much better conditions of life. It is, therefore, most reasonable to say that out of the 390 vascular plants found in Greenland, only abt. 74 were derived from European sources, partly through human agency; the remainder are probably of western origin, or in some cases, were living in Greenland prior to the glacial maximum.

In conclusion, we may briefly consider the routes by which species might be supposed to make their way into Greenland from west and east. The distance from North America is least on the north, via Smith Sound and Kennedy Channel, and it is natural to suppose that this route has been much used and is still in use; two species of *Pedicularis (P. arctica* and *P. capitata)* have, as already noted, only been found in Greenland in Inglefield Land, close to Smith Sound; these were probably recent arrivals from Ellesmere Land. They are otherwise found all through arctic America. Naturally the high-arctic and arctic species in particular have utilised this route, and some of them have gone only southwards in West Greenland, others have also gone to the northward, round the north of Greenland.

In 1905 Ad. S. Jensen and P. Harder mentioned some

shell strata in the Vaigat region about lat. 70° N., containing shells of mussels no longer found so far to the north as Greenland, their present northern limit lying at the Gulf of St. Lawrence. As these shell strata are considered post-glacial, they afford certain evidence of a warmer post-glacial period, and in the course of such a warm period, several American plant species which cannot now be supposed to follow so northerly a route as that via Smith Sound, might have gone that way. They would then have been driven farther south, when the climate became colder.

But farther to the south again, West Greenland must also have received a considerable contingent of American species, in the many sub-arctic and boreal species; these must have come across Davis Strait.

Turning to East Greenland we find, in the extreme north, some species (e. g. *Draba Adamsii*, *D. repens* and *Epilobium arcticum*, *Arenaria pseudofrigida*), which must have come from Spitsbergen and other arctic islands in that neighbourhood; farther south, we find a little group of species which must presumably have come from Iceland to the Angmagsalik area (*Alchimilla acutidens*, *Sedum acre*, possibly *Hieracium alpinum*). For the rest, it is impossible to go further into detail as to the routes followed by the immigrants from the east. —

As to the manner in which each of the species was transported, this is a difficult question. The natural means of transport are by the aid of water, wind, and animals.

First as regards the water, in its fluid state, it is of no great importance as a means of immigration where Greenland is concerned, as only a small number of sea-shore plants (abt. 15) have been found here. Only *Mertensia maritima*, *Potentilla anserina*, *Honckenya peploides*

and a few species of *Carex* and *Puccinellia* may be supposed to have been brought by the ocean currents (*Lathyrus maritimus* and *Atriplex* are considered as having been brought by the Norsemen). But the importance of water in a frozen state must on the other hand be particularly emphasised. Where the sea ice lies firm throughout the winter, it forms a splendid field for the transport of wind-borne seeds and fragments of plants; moreover, the wind at that season is often very strong. The distance across Smith Sound for instance, is a mere nothing when the sound is frozen over.

Where sea ice is carried along by currents, as is particularly the case on the East Coast of Greenland, it will also doubtless be able to carry portions of plants from other countries; this would explain the occurrence of eastern species in northern East Greenland. Several of the peculiar species moreover (e. g. *Polemonium boreale*, *Arenaria pseudofrigida*) are positively restricted to the extreme coastal districts, which seems to argue in favour of this mode of immigration.

The importance of the wind in spreading seeds throughout these regions is doubtless very considerable, especially in winter, when the snow, or as just noted, the ice, covers the surface. Nearly all the plants found in Greenland have rather small seeds; only a few (some of the *Compositæ*, *Salices*, *Eriophorum*, *Epilobium* and *Dryas*) have special adaptation for wind transport in the form of hairs and pappus.

It is characteristic in this respect that several plant families in which the seeds or fruits are as a rule comparatively large, and without special aids to transportation, are altogether lacking in the flora of Greenland, though they

may be represented in other arctic countries having an unbroken land-connection with subarctic and boreal regions. Thus for instance the *Leguminosæ*, of which we find, for instance, in arctic America, several species of the genera *Astragalus*, *Oxytropis*, *Hedysarum* and *Lupinus*. These are altogether lacking in Greenland, and the only two *Leguminosæ* (*Vicia cracca* and *Lathyrus maritimus*) found there are supposed to have been brought by the Norsemen (*Lathyrus maritimus* is also a shore plant). Of the *Borraginaceæ*, Greenland has only the shore plant *Mertensia maritima*, the fruit of which can be carried along by the sea water, while widely distributed circumpolar species such as f. i. *Myosotis silvatica var. alpestris* are lacking. Among the *Compositæ*, species of the genus *Chrysanthemum* etc. are absent, though found in arctic America; these have no special equipment for wind transport. Several other similar examples might be quoted; the above will, however, suffice to show that the sea has proved a barrier to several species which might certainly thrive in Greenland as far as climate is concerned.

Finally, as regards animals, that is to say, birds, we find only few species (11 in all: *Juniperus*, two *Rubus*, *Sorbus*, *Empetrum*, two *Cornus*, *Oxycoccus*, two *Vaccinium*, and *Streptopus)* with fleshy fruits. There are also other ways in which birds crossing from the shores of N. America to Greenland might be supposed to aid immigration; it should be added, however, that very few species have burrs or other means of attachment *(Linnæa, Galium, Anemone Richardsonii).*

Altogether then, I do not think that there is any need to have recourse to land-connections in order to explain the immigration of plants into Greenland. That part of the flora which has come in since the glacial maximum came either

through human agency or by the aid of Nature, and there is not any need of supposing an alteration in the configuration of the land.

Summary.

Our knowledge of the distribution of vascular cryptogams and phanerogams in Greenland is now so complete that it is time to make some phyto-geographical observations.

With the delimitation of species used by the present writer, the flora of Greenland comprises 390 vascular cryptogams and phanerogams. The General List at the end of this paper shows these 390 species and their distribution in Greenland.

Greenland may be divided into 15 phyto-geographical districts, the West Coast and East Coast being taken separately, as the whole of the interior is occupied by the inland ice, with no vegetation.

A list (table II) on p. 23 gives the number of species in each district, grouped according to distribution outside Greenland; also according to 3 phyto-geographical categories (high-arctic, arctic and sub-arctic to boreal); and further as to how many species in each district are found only on the West Coast or only on the East Coast, and how many (32) extend from the North Coast (abt. 83° N. Lat.) to the southern extremity (abt. 60° N. Lat.).

Owing *inter alia* to finds of species on nunataks (i. e. areas rising above the inland ice), it is supposed that some species (abt. 60) may have survived the glacial maximum in Greenland.

It is shown that the Norse colonisation (abt. 985—1450 A. D.) must have been of great importance to the com-

position of the flora of south-western Greenland; some 50 species are presumed to have been brought in by this colonisation.

The West Coast of Greenland is far richer in species than the East Coast (134 species are only found on the West Coast). This is due to: 1) more ice-free land, 2) a more sheltered situation, 3) a shorter distance from the nearest adjacent land (N. America), and 4) the influence of the Norse colonisation.

The East Coast has only 9 species not found in the West.

North Greenland, i. e. Greenland north of 76° N. Lat. forms a natural area with 8 species peculiar to itself. It is very poor as regards the number of species (125 in all) owing to the severe conditions of life (northerly situation).

The high-arctic species decrease in number from north to south, both on the West and East Coasts, and the subarctic and boreal increase correspondingly; arctic species in a wider sense have their maximum about midway down, both on the West and East Coasts, decreasing thence both to the north and south (see graph p. 33).

Of the 8 endemic species, all of which belong to critical genera, 4 species of *Hieracium* are remarkable in that they must be assumed to have descended from species introduced during the Norse colonisation; the origin of these species cannot thus be more than at most 900 years old.

After detailed consideration of the various phyto-geographical groups into which the species are distributed, and having regard to their distribution outside Greenland, the writer comes to the conclusion that 74 species (of which 50 brought by the Norsemen) are immigrants from Europe; the remainder (316) must most probably be regarded as

having come from America, or (as regards some 60 species) have lived in Greenland prior to the glacial maximum.

Among immigration routes, special attention is drawn to the narrow Smith Sound and Kennedy Channel to the NW, and to the fact that a post-glacial heat maximum existed, so that this route could be followed by more southerly species than at the present day. Furthermore, mention is made of immigration from the NE with the drift ice of the polar current; otherwise, immigration must have been effected by wind and birds carrying seeds etc. across the sea. Special importance probably attaches to the action of the wind in winter, when seeds and portions of plants can be swept along over the frozen straits before the storm. It is considered unnecessary to assume any post-glacial land-connection to the west and east.

Explanations to the General List on pp. 54—69.

The *W* and *E* prefixed to the plant names mean that the species in question occurs only in West, respectively East Greenland.

The letters (*G*, *A*, *S* etc.) after the tabular indications of distribution have been explained on p. 24.

The plant names printed in italics are the names of the supposed old Norse plants.

List of the Phanerogams and Pteridophytes of Greenland with their Distribution.

Areas of the botanical districts	W. 83°-80° Lat. N.	W. 80°-76°	W. 76°-71°	W. 71°-69°	W. Disko	W. 69°-66°	W. 66°-64°	S. 64°-61°	S. 61°-60°-61°	S. 61°-65°	E. Angmagsalik	E. 67°-70°	E. Scoresby S.	E. 72°-76°	E. 76°-81°	E. 81°-83° Lat. N.	
District no.	VIII	VII	VI	Va	Vb	IV	III	II	I	II	III	IV	V	VI	VII	VIII	
Equisetum arvense	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.	S G
W — hiemale	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
W — scirpoides	.	.	.	.	—	—	—	—	—	.	.	.	.	.	.	.	A_2D
W — silvaticum	.	.	.	.	.	.	—	—	—	.	.	.	.	.	.	.	S D
— variegatum	—	—	—	—	—	—	—	—	—	?	—	—	—	—	—	.	A_2G
W Isoëtes echinosporum, var.	.	.	.	.	.	—	.	—	—	.	.	.	.	.	.	.	S G
W — lacustre	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S D
Lycopodium alpinum	.	.	.	—	—	—	—	—	—	—	—	?	—	.	.	.	A_2G
— annotinum	.	.	—	—	—	—	—	—	—	—	—	?	—	.	.	.	S G
W — clavatum	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
— complanatum, var.	.	.	.	.	—	.	—	—	—	?	—	.	.	.	.	.	S D
— selago	.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.	A_2G
W Botrychium boreale	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S D
— lanceolatum	.	.	.	.	—	.	—	—	—	?	—	.	.	.	.	.	S G
— lunaria	.	.	.	—	—	—	—	—	—	—	—	—	—	.	.	.	S G
W — simplex	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S D
Asplenium viride	.	.	.	.	.	.	.	—	—	?	—	.	.	.	.	.	S D
W Athyrium alpestre	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	A_2G
Cystopteris fragilis	.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S G
W — montana	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S D

	Dryopteris dilatata	.	.	.	.	—	—	—	—	—	—	.	.	.	.	.	.	S G
W	— filix mas	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S G
	— fragrans	.	—	—	—	—	—	.	.	.	.	.	.	—	.	.	.	A_1A
	— phegopteris	.	.	.	.	.	.	—	—	—	—	—	.	.	.	.	.	S G
	— pulchella	.	.	.	.	—	—	—	—	—	—	—	.	.	.	.	.	S G
	Polystichum lonchitis	.	.	.	.	—	.	—	—	—	—	—	.	.	.	.	.	S G
	Woodsia glabella	.	—	—	—	—	—	.	.	.	.	—	—	—	—	—	—	A_1D
	— ilvenis	.	.	—	—	—	—	—	—	—	-	—	—	—	—	.	.	S G
W	Selaginella selaginoides	.	.	.	.	.	.	—	—	—	.	.	.	.	.	.	.	S G
	Juniperus communis	.	.	.	.	.	—	—	—	—	—	—	.	.	.	.	.	S G
W	Alnus crispa	.	.	.	.	.	.	—	—	—	.	.	.	.	.	.	.	S A
	Betula glandulosa	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S A
	— nana	.	.	—	—	—	—	—	—	.	.	—	—	—	—	.	.	A_2G
W	— *pubescens*	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S E
W	Callitriche anceps	.	.	.	.	—	—	—	—	—	.	.	.	.	.	.	.	S A
W	— autumnalis	.	.	.	.	—	—	.	.	.	.	.	.	.	.	.	.	S G
	— hamulata	.	.	.	.	.	.	—	—	—	.	?	.	.	.	.	.	S G
	— verna	.	.	.	—	—	—	.	.	—	.	—	.	—	.	.	.	S G
W	Arenaria cil. norvegica	.	—	—	—	—	.	.	.	.	.	.	.	.	.	.	.	A_2G
E	— - pseudofrigida	.	.	.	.	.	.	.	.	.	.	.	.	—	—	—	.	A_1E
	Cerastium alpinum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.	A_2G
W	— arvense	.	.	.	.	.	—	.	.	.	.	.	.	.	.	.	.	S G
W	— *cæspitosum, alp.*	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S G
	— trigynum	.	.	.	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2G
	Honckenya peploides	.	—	—	—	—	—	—	—	—	—	—	—	—	—	.	.	S G
	Melandrium apetalum	—	—	—	—	—	—	.	.	.	.	.	.	—	—	—	.	A_1D
	— pauciflorum	.	—	—	—	—	—	.	.	.	.	.	.	—	—	—	—	A_1D
	— triflorum	—	—	—	—	—	—	.	.	.	.	.	.	.	—	—	—	A_1A
	Minuartia biflora	.	.	—	—	—	—	—	—	—	—	—	—	—	—	—	.	A_2G
	— groenlandica	.	.	.	.	.	—	—	—	—	—	.	.	.	.	.	.	S A

Areas of botanical districts	W.							S.				E.					
	83°-80° Lat. N.	80°-76°	76°-71°	71°-69°	Disko	69°-66°	66°-64°	64°-61°	61°-60°-61°	61°-65°	Angmagsalik	67°-70°	Scoresby S.	72°-76°	76°-81°	81°-83° Lat. N.	
District no.	VIII	VII	VI	V a	V b	IV	III	II	I	II	III	IV	V	VI	VII	VIII	
Minuartia Rossii	—	.	.	.	.	.	.	.	.	.	.	.	.	.	—	.	A_1C
— rubella	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
— stricta	.	.	.	—	—	—	.	.	.	.	.	.	—	.	.	.	A_2G
W Sagina cæspitosa	.	.	—	—	—	—	—	—	—	.	.	.	.	.	.	.	A_2D
— intermedia	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
— Linnæi	.	.	.	.	—	—	—	—	—	—	—	.	.	.	.	.	S G
W — *nodosa*	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	.	S G
W — *procumbens*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
Silene acaulis	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
Stellaria borealis	.	.	.	.	—	—	—	—	—	—	—	.	.	.	.	.	S G
— humifusa	.	—	—	—	—	—	—	—	—	—	—	—	—	—	.	.	A_2G
— longipes	—	—	—	—	—	—	—	—	.	.	.	.	—	—	?	—	A_1D
W — *media*	.	.	.	.	.	—	.	—	—	.	.	.	.	.	.	.	S E
Viscaria alpina	.	.	—	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2G
W *Atriplex sp.*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
W Cornus canadensis	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S A
— suecica	.	.	.	.	.	—	—	—	—	—	.	.	.	.	.	.	S G
E Sedum acre	.	.	.	.	.	.	.	.	.	.	—	.	.	.	.	.	S E
— annuum	.	.	.	.	.	.	—	—	—	—	—	.	.	.	.	.	S E
— roseum	.	.	.	.	.	—	—	—	—	—	—	—	—	—	.	.	S G
— villosum	.	.	.	—	—	—	—	—	—	?	—	.	.	.	.	.	S G

	Arabis alpina	.	.	—	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2G
	— arenicola	.	.	—	—	—	—	—	—	.	.	.	.	—	.	.	.	A_2A
	— Holboellii	.	.	.	—	—	—	—	—	.	.	.	.	—	.	.	.	A_2A
W	— Hookeri	.	—	.	—	—	—	—	.	.	.	.	.	.	.	.	.	A_2A
E	Braya glabella	.	.	.	.	.	.	.	.	.	.	.	.	—	—	.	.	A_1D
W	— humilis	.	.	.	.	.	—	.	.	.	.	.	.	.	.	.	.	A_2A
	— purpurascens	—	—	—	—	—	.	.	.	.	.	.	.	—	—	—	—	A_1D
	— Thorild-Wulffii	—	—	.	.	.	.	.	.	.	.	.	.	.	.	—	.	A_1H
W	*Capsella buosa pastoris*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S E
	Cardamine bellidifolia	—	—	—	—	—	—	—	—	.	—	—	—	—	—	—	—	A_2G
	— pratensis	.	—	—	—	—	—	—	—	—	?	—	—	—	—	—	.	S G
	Cochlearia off. groenlandica	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.	A_2G
	Draba Adamsii	—	—	.	.	.	.	.	.	.	.	.	.	.	—	.	.	A_1F
	— alpina	—	—	—	—	—	—	.	.	.	.	.	—	—	—	—	—	A_1G
	— aurea	.	.	—	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2A
	— cinerea	—	—	—	—	—	—	.	.	.	.	—	—	—	—	—	—	A_1D
	— crassifolia	.	.	—	—	—	—	—	.	.	.	—	—	—	.	.	.	A_2D
	— hirta (borea)	.	.	—	—	—	—	—	—	—	—	—	—	—	—	—	.	A_2G
	— incana	.	.	.	.	.	—	—	—	—	—	—	.	.	.	.	.	S G
	— nivalis	.	—	—	—	—	—	—	—	—	—	—	—	—	—	.	.	A_2G
E	— repens	.	.	.	.	.	.	.	.	.	.	.	.	—	.	.	.	A_2F
	— rupestris	.	.	.	.	.	.	—	—	—	—	—	.	.	.	.	.	S G
W	— stylaris	.	.	.	—	—	—	—	.	.	.	.	.	.	.	.	.	S C
	— subcapitata	—	—	—	—	.	.	.	.	.	.	.	.	—	—	—	—	A_1C
	— Wahlenbergii	—	—	—	—	—	—	—	.	.	.	—	—	—	—	—	—	A_1D
	Eutrema Edwardsii	—	—	—	—	.	.	.	.	.	.	.	.	.	—	—	.	A_1C
W	Hesperis Pallasii	—	—	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A_1C
	Lesquerella arctica	—	—	—	—	—	.	.	.	.	.	.	.	—	—	—	.	A_1A
W	Radicula islandica	.	.	.	.	.	—	.	.	—	.	.	.	.	.	.	.	S G
	Subularia aquatica	.	.	.	.	.	.	.	.	—	.	—	.	.	.	.	.	S G

Areas of the botanical districts	W.							S.			E.						
	83°-80° Lat. N.	80°-76°	76°-71°	71°-69°	Disko	69°66°	66°-64°	64°-61°	61°-60°-61°	61°-65°	Angmagsalik	67°-70°	Scoresby S.	72°-76°	76°-81°	81°-83° Lat. N.	
District no.	VIII	VII	VI	Va	Vb	IV	III	II	I	II	III	IV	V	VI	VII	VIII	
W *Drosera rotundifolia*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
Empetrum nigrum	.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.	S G
W *Geranium silvaticum*	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	.	S E
Hippuris vulgaris	.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.	S G
W Myriophyllum alterniflorum	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S G
W — spicatum, var.	.	.	.	—	—	—	.	.	.	.	.	.	.	.	.	.	S G
Epilobium anagallidifolium	.	.	.	.	—	—	—	—	—	—	—	.	.	.	.	.	S G
— angustifolium	.	.	.	.	—	—	—	—	—	—	—	.	.	.	.	.	S G
— arcticum	.	.	—	—	—	.	.	.	.	.	.	.	—	.	.	.	A_2F
— Hornemanni	.	.	.	.	—	—	—	—	—	—	—	.	.	.	.	.	S G
— lactiflorum	.	.	.	.	—	.	—	—	—	—	—	.	.	.	.	.	S G
— latifolium	.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2B
W — *palustre*	.	.	.	.	—	.	—	—	—	.	.	.	.	.	.	.	S G
W *Lathyrus maritimus*	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S G
W *Vicia cracca*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
Papaver nudicaule	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
Koenigia islandica	.	—	—	—	—	—	—	—	—	—	—	—	—	—	.	.	A_2G
Oxyria digyna	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
W Polygonum aviculare	.	.	.	—	—	—	—	—	—	.	.	.	.	.	.	.	S G
— viviparum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
W Rumex *acetosa*	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S E

	— acetosella	.	.	—	—	—	—	—	—	—	?	—	—	—	—	.	.	S G
W	— *domesticus*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S E
	Montia lamprosperma	.	.	.	—	—	—	—	—	—	—	.	.	.	.	.	.	S G
W	Anemone Richardsonii	.	.	.	.	.	—	—	.	.	.	.	.	.	.	.	.	S A
	Coptis trifolia	.	.	.	.	.	—	—	—	—	—	—	.	.	.	.	.	S A
	Ranunculus acer	.	.	.	.	.	—	—	—	—	—	—	.	.	.	.	.	S E
	— affinis	.	—	—	—	—	—	.	.	.	.	.	—	—	—	.	.	A_1C
W	— cymbalaria	.	.	.	.	.	.	—	.	.	.	.	.	.	.	.	.	S D
E	— glacialis	.	.	.	.	.	.	.	.	.	.	—	—	—	—	—	.	A_2E
	— hyperboreus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.	A_2G
W	— lapponicus	.	.	—	—	—	—	—	.	.	.	.	.	.	.	.	.	A_2D
	— nivalis	.	.	—	—	—	—	.	.	.	.	.	.	—	—	.	.	A_2D
	— pygmæus	.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.	A_2G
	— reptans	.	.	.	—	—	—	—	—	—	?	—	.	.	.	.	.	S G
W	— Sabinei	—	—	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A_1A
	— sulphureus	—	—	—	—	—	.	.	.	.	.	.	.	—	—	—	—	A_1C
	— trichophyllus, var.	.	—	—	—	—	—	—	—	—	?	—	—	—	.	.	.	S G
	Thalictrum alpinum	.	.	.	—	—	—	—	—	—	—	—	—	—	.	.	.	S G
	Alchimilla alpina	.	.	.	.	.	—	—	—	—	—	—	.	.	.	.	.	S G
E	— acutidens	.	.	.	.	.	.	.	.	.	.	—	.	.	.	.	.	S E
	— glomerulans	.	.	.	.	—	—	—	—	—	—	—	?	—	.	.	.	S G
	— minor	.	.	.	.	.	—	—	—	—	—	—	.	.	.	.	.	S G
	Dryas integrifolia	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2A
	— octopetala	.	—	.	.	.	.	.	.	.	.	.	.	—	—	—	—	A_2G
	Potentilla anserina s. l.	.	.	.	—	—	—	—	—	—	?	—	.	.	.	.	.	S G
	— emarginata	—	—	—	—	—	—	.	.	.	.	.	—	—	—	—	—	A_1C
	— maculata	.	.	.	—	—	—	—	—	—	—	—	—	—	.	.	.	S G
	— nivea s. l.	—	—	—	—	—	—	—	.	.	.	.	—	—	—	—	—	A_1D
	— palustris	.	.	.	.	.	—	—	—	—	—	—	.	.	.	.	.	S G
	— Pedersenii	—	—	.	—	.	.	.	.	.	.	.	.	.	—	—	—	A_1A

Areas of the botanical districts	W.							S.			E.						
	83°-80° Lat. N.	80°-76°	76°-71°	71°-69°	Disko	69°-66°	66°-64°	64°-61°	61°-60°-61°	61°-65°	Angmagsalik	67°-70°	Scoresby S.	72°-76°	76°-81°	81°-83° Lat. N.	
District no.	VIII	VII	VI	Va	Vb	IV	III	II	I	II	III	IV	V	VI	VII	VIII	
Potentilla pulchella	—	—	—	—	—	.	.	.	.	.	.	.	—	—	—	—	A_1C
W — Ranunculus	.	.	.	—	—	.	.	.	.	.	.	.	.	.	.	.	A_2A
— tridentata	.	.	.	—	—	—	—	—	—	—	—	—	.	.	.	.	S A
W — Vahliana	.	—	—	—	—	—	.	.	.	.	.	.	.	.	.	.	A_1A
W *Rubus chamæmorus*	.	.	.	.	.	.	—	—	—	.	.	.	.	.	.	.	S D
W — *saxatilis*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S E
Sibbaldia procumbens	.	.	—	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2G
W Sorbus decora	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S A
Salix arctica	—	—	—	—	.	.	.	.	.	.	.	.	—	—	—	—	A_1C
— chloroclados	.	.	—	—	—	—	—	.	.	.	—	—	—	—	.	.	A_2A
— glauca	.	.	—	—	—	—	—	—	—	—	—	—	—	—	.	.	A_2G
— herbacea	.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.	A_2G
W — uva ursi	.	.	.	.	.	.	—	—	—	.	.	.	.	.	.	.	S A
W Parnassia Kotzebui	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S A
Saxifraga aizoides	.	.	—	—	—	—	—	—	—	—	—	—	—	—	.	.	A_2G
— aizoon	.	.	—	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2G
— cernua	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
— flagellaris	—	—	.	.	.	.	.	.	.	.	.	.	.	—	—	—	A_1C
— groenlandica	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
E — hieraciifolia	.	.	.	.	.	.	.	.	.	.	.	.	—	—	.	.	A_2D
— hirculus	.	—	.	.	.	.	.	.	.	.	.	.	.	—	.	.	A_2G

— nivalis	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
— oppositifolia	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
— rivularis	.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.	A_2G
— stellaris	.	.	.	.	.	.	—	—	—	—	—	.	.	.	.	.	S G
— — var. comosa	—	—	—	—	—	—	—	.	.	.	.	—	—	—	—	.	A_1D
— tricuspidata	.	—	—	—	—	—	—	.	.	.	.	—	—	.	.	.	A_1A
Archangelica officinalis	.	.	.	.	—	—	—	—	—	—	—	.	.	.	.	.	S E
W *Haloscias scoticum*	.	.	.	.	.	.	—	—	—	.	.	.	.	.	.	.	S G
W *Viola canina s. l.*	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S E
W — labradorica	.	.	.	.	.	.	—	—	—	.	.	.	.	.	.	.	S A
— palustris	.	.	.	.	.	.	.	—	—	—	—	.	.	.	.	.	S G
W — Selkirkii	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	.	S D
	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
Mertensia maritima	.	—	—	—	—	—	.	.	.	.	—	.	.	.	.	.	A_2G
Campanula rotundifolia	.	.	—	—	—	—	—	—	—	—	—	—	—	—	.	.	S G
— uniflora	.	—	—	—	—	—	—	—	.	.	—	—	—	—	—	.	A_2G
W Linnæa borealis	.	.	.	.	—	—	.	.	—	.	.	.	.	.	.	.	S D
W *Achillea millefolium*	.	.	.	.	.	.	—	.	—	.	.	.	.	.	.	.	S G
Antennaria alpina	.	—	—	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2G
— — var. glabrata	.	.	—	—	—	—	—	.	.	.	—	—	—	.	.	.	A_2D
— groenlandica	.	.	.	.	—	—	—	—	—	—	—	.	.	.	.	.	S A
W — intermedia	.	.	.	—	—	—	—	—	.	.	.	.	.	.	.	.	A_2H
Arnica alpina	.	—	—	—	—	—	—	.	.	.	—	—	—	—	—	.	A_1D
W Artemisia borealis	.	.	—	—	—	—	—	.	.	.	.	.	.	.	.	.	A_2A
Erigeron borealis	.	.	.	.	.	.	—	—	—	—	.	.	.	.	.	.	S G
— compositus	—	—	—	—	—	—	—	—	—	.	.	.	—	—	—	—	A_1A
— eriocephalus	—	—	—	—	—	—	.	.	.	.	.	.	?	—	.	.	A_1D
— unalaschkensis	.	.	—	—	—	—	—	—	.	—	—	—	—	.	.	.	A_2G
— uniflorus			.	.	.	—	—	—	—	—	—	.	.	.	.	.	A_2G
Gnaphalium norvegicum	.	.	.	.	—	.	—	—	—	—	—	.	.	.	.	.	S G

	Areas of the botanical districts	W. 83°-80° Lat. N.	W. 80°-76°	W. 76°-71°	W. 71°-69°	W. Disko	W. 69°-66°	W. 66°-64°	S. 64°-61°	S. 61°-60°-61°	S. 61°-65°	E. Anmagsalik	E. 67°-70°	E. Scoresby S.	E. 72°-76°	E. 76°-81°	E. 81°-83° Lat. N.	
	District no.	VIII	VII	VI	Va	Vb	IV	III	II	I	II	III	IV	V	VI	VII	VIII	
	Gnaphalium supinum	.	.	.	—	—	—	—	—	—	—	—	.	.	.	.	.	A_2G
W	— *uliginosum*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
	Hieracium alpinum	.	.	.	.	.	.	.	—	—	—	—	—	—	.	.	.	S E
	— *groenlandicum*	.	.	.	.	—	—	—	—	—	—	—	.	.	.	.	.	S H
	— *hyparcticum*	.	.	.	.	.	—	—	—	—	—	—	.	.	.	.	.	S H
W	— *lividorubens*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S H
W	— *rigorosum*	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S H
W	*Leontodon autumnalis*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S E
W	*Matricaria inodora v. grandiflora*	.	.	.	.	.	.	.	.	—	.	.	.	.	?	.	.	S G
	Taraxacum arcticum	—	.	.	.	.	.	.	.	.	.	.	.	—	—	—	.	A_1F
W	— arctogenum	—	—	.	—	.	.	.	.	.	.	.	.	.	.	.	.	A_1H
	— brachyceras	.	.	.	.	.	.	.	.	—	.	.	.	—	.	.	.	A_2E
	— croceum	.	.	.	—	—	—	—	—	—	—	—	—	—	.	.	.	S G
W	— groenlandicum	.	.	—	—	—	—	.	.	.	.	.	.	.	.	.	.	A_2A
W	— hyparcticum	—	—	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A_1A
	— phymatocarpum	—	—	—	—	—	.	.	.	.	.	.	.	—	—	—	—	A_1C
W	— pumilum	—	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A_1A
	Diapensia lapponica	.	.	—	—	—	—	—	—	—	—	—	?	—	.	.	.	A_2G
W	Andromeda glaucophylla	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	.	S A
W	— polifolia	.	.	.	.	.	—	.	.	.	.	.	.	.	—	.	.	S D
	Arctostaphylos alpina	.	.	.	—	—	—	—	.	.	.	.	.	—	—	.	.	A_2D

W	— uva ursi	.	.	.	.	.	—	.	.	.	.	.	.	.	.	.	.	S G
	Bryanthus coeruleus	.	.	—	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2G
	Cassiope hypnoides	.	.	—	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2G
	— tetragona	—	—	—	—	—	—	—	.	.	.	—	—	—	—	—	—	A_1D
W	Ledum decumbens	.	.	—	—	—	—	—	.	.	.	.	.	.	.	.	.	A_2A
W	— groenlandicum	.	.	.	.	.	—	—	—	—	.	.	.	.	.	.	.	S A
	Loiseleuria procumbens	.	.	—	—	—	—	—	—	—	—	—	—	.	.	.	.	A_2G
W	Oxycoccus quadripetalus	.	.	.	.	.	.	—	—	—	.	.	.	.	.	.	.	S G
	Rhododendron lapponicum	.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.	A_2D
	Vaccinium uliginosum, var.	.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.	A_2G
W	— vitis idæa, var.	.	—	.	—	—	—	—	.	.	.	.	.	.	.	.	.	S G
	Gentiana aurea	.	.	.	.	—	.	.	—	—	?	—	.	.	.	.	.	S G
	— nivalis	.	.	.	.	—	—	—	—	—	—	—	.	.	.	.	.	S G
W	— serrata	.	.	.	.	.	—	.	.	—	.	.	.	.	.	.	.	S G
	— tenella	.	.	.	.	.	—	.	.	.	.	.	.	—	—	.	.	A_2G
W	Lomatogonium rotatum	.	.	.	.	.	—	—	—	—	.	.	.	.	.	.	.	S G
W	Menyanthes trifoliata	.	.	.	.	.	—	—	—	—	.	.	.	.	.	.	.	S G
	Thymus serpyllum, var.	.	.	.	.	.	—	—	—	—	—	—	.	.	.	.	.	S E
	Pinguicula vulgaris	.	.	.	—	—	—	—	—	—	—	—	?	—	.	.	.	S G
W	Utricularia intermedia	.	.	.	.	.	—	.	.	.	.	.	.	.	.	.	.	S D
W	— ochroleuca	.	.	.	—	.	—	.	.	.	.	.	.	.	.	.	.	S E
W	— minor	.	.	.	.	.	—	.	.	—	.	.	.	.	.	.	.	S G
	Pirola grandiflora	.	—	—	—	—	—	—	—	—	—	—	—	—	—	.	.	A_2A
	— minor	.	.	.	.	—	—	—	—	—	—	—	.	.	.	.	.	S G
W	— secunda	.	.	.	.	—	—	.	.	.	.	.	.	.	.	.	.	S G
	Plantago maritima, var.	.	.	.	—	—	—	—	—	—	—	—	.	.	.	.	.	S G
	Armeria vulg. sibirica	.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
E	Polemonium boreale	.	.	.	.	.	.	.	.	.	.	.	.	.	—	.	.	A_2C
W	Primula egalikensis	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	.	S A
W	— farinosa groenlandica	.	.	.	—	—	—	—	.	.	.	.	.	.	.	.	.	A_2A

Areas of the botanical districts	W. 83°-80° Lat. N.	W. 80°-76°	W. 76°-71°	W. 71°-69°	W. Disko	W. 69°-66°	S. 66°-64°	S. 64°-61°	S. 61°-60°-61°	S. 61°-65°	E. Angmagssalik	E. 67°-70°	E. Scoresby S.	E. 72°-76°	E. 76°-81°	E. 81°-83° Lat. N.	
District no.	VIII	VII	VI	Va	Vb	IV	III	II	I	II	III	IV	V	VI	VII	VIII	
Galium Brandegei	.	.	.	.	.	.	—	?	—	?	—	.	.	.	.	.	S A
W — *triflorum*	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S D
Bartschia alpina	.	.	—	—	—	—	—	—	—	—	—	—	.	.	.	.	A_2G
Euphrasia latifolia	.	.	—	—	—	—	—	—	—	—	—	—	—	—	.	.	A_2G
W Limosella aquatica	.	.	.	—	.	.	.	.	—	.	.	.	.	.	.	.	S G
W Pedicularis arctica	.	—	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A_1A
W — capitata	.	—	.	.	.	.	.	.	.	.	.	.	.	.	.	.	A_1A
W — euphrasioides	.	.	.	.	.	—	—	—	.	.	.	.	.	.	.	.	S A
— flammea	.	.	—	—	—	—	—	—	—	—	—	—	—	—	—	.	A_2G
W — groenlandica	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S A
— hirsuta	—	—	—	—	—	—	—	.	.	.	—	—	—	—	—	—	A_1D
W — lanata	.	.	—	—	—	—	.	.	.	.	.	.	.	.	.	.	A_2C
— lapponica	.	.	—	—	—	—	—	—	.	.	.	.	—	—	.	.	A_2D
W *Rhinanthus groenlandicus*	.	.	.	.	.	.	—	—	—	.	.	.	.	.	.	.	S G
Veronica alpina	.	.	.	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2G
— fructicans	.	.	.	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2E
	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
Carex alpina (Halleri)	.	.	—	—	—	—	—	—	—	.	.	.	—	.	.	.	A_2G
W — aquatilis stans	—	—	—	—	—	—	.	.	.	.	.	.	.	.	.	.	A_1A
— atrata	.	.	.	.	.	.	.	—	—	—	—	.	.	.	.	.	S E
— atrofusca	.	.	—	—	.	.	.	.	.	.	.	.	—	.	.	.	A_2D

	—	bicolor	.	.	.	—	—	—	—	—	.	.	.	—	—	.	.	.	A_2G
	—	brunescens	.	.	.	.	.	—	—	—	—	—	—	.	.	.	.	.	S G
	—	canescens	.	.	.	.	.	—	—	—	—	—	.	.	.	.	.	.	S G
	—	capillaris	.	—	—	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2G
	—	capitata	.	.	—	—	—	—	—	—	—	—	—	—	.	.	.	.	A_2G
	—	deflexa	.	.	.	.	.	.	—	—	—	—	.	.	.	.	.	.	S A
	—	glareosa	.	—	—	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2G
W	—	*Goodenovii*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
W	—	gynocrates	.	.	.	—	—	—	—	—	—	.	.	.	.	.	.	.	S A
W	—	holostoma	.	.	.	—	—	—	.	.	.	.	.	.	.	.	.	.	A_2E
	—	incurva	.	—	—	—	—	—	—	—	—	.	.	.	—	—	—	.	A_2G
	—	Lachenalii	.	.	—	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2G
W	—	*Lyngbyei*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S E
	—	Macloviana	.	.	.	—	—	—	—	—	—	?	—	—	—	.	.	.	A_2G
	—	microglochin	.	.	.	—	—	—	.	.	—	?	—	.	—	.	.	.	A_2G
	—	misandra	—	—	—	—	—	—	.	.	.	.	.	—	—	—	—	.	A_1D
	—	nardina	—	—	—	—	—	—	—	—	—	?	—	—	—	—	—	—	A_2G
W	—	*Oederi*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
W	—	*panicea*	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S E
E	—	parallela	.	.	.	.	.	.	.	.	.	.	.	.	—	.	.	.	A_2E
	—	pedata (glacialis)	.	.	—	—	—	—	—	.	.	.	—	—	—	.	.	.	A_2G
W	—	*polygama*	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	.	S D
W	—	pratensis	.	.	.	.	.	—	—	—	—	.	.	.	.	.	.	.	S A
	—	rariflora	.	.	—	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2G
	—	rigida	.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.	A_2G
W	—	*rostrata*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
	—	rotundata	.	.	.	—	—	—	—	—	—	—	—	?	—	.	.	.	A_2D
W	—	rufina	.	.	.	.	—	—	—	.	—	.	.	.	.	.	.	.	A_2E
	—	rupestris	.	—	—	—	—	—	.	.	.	.	—	—	—	—	—	.	A_1G
	—	saxatilis	.	—	—	—	—	—	.	.	.	.	.	.	—	—	—	.	A_2G

Areas of the botanical districts	W.							S.				E.					
	83°-80° Lat. N.	80°-76°	76°-71°	71°-69°	Disko	69°-66°	66°-64°	64°-61°	61°-60°-61	61°-65°	Angmagsalik	67°-70°	Scoresby S.	72°-76°	76°-81°	81°-83° Lat. N.	
District no.	VIII	VII	VI	Va	Vb	IV	III	II	I	II	III	IV	V	VI	VII	VIII	
Carex scirpoidea	.	.	—	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2D
W — *stylosa*	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S D
— subspathacea	.	.	.	—	—	—	—	—	—	—	—	—	—	—	—	.	A_2G
— supina	.	.	—	—	—	—	—	—	—	?	—	—	—	—	.	.	S C
— ursina	.	.	.	—	—	—	.	.	.	.	.	.	—	—	.	.	A_2C
Cobresia Bellardi	—	—	—	—	—	—	—	—	—	?	—	—	—	—	—	.	A_2G
— bipartita	.	.	—	—	—	—	—	.	.	.	.	.	—	—	—	.	A_2D
Eriophorum polystachyum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S G
— Scheuchzeri	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
W Heleocharis acicularis	.	.	—	—	—	—	.	.	.	.	.	.	.	.	.	.	S G
W — *uniglumis*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
Scirpus cæspitosus, var.	.	.	—	—	—	—	—	—	—	—	—	—	.	.	.	.	S G
W — *pauciflorus*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
W Agropyrum violaceum	.	.	.	—	—	—	.	—	—	.	.	.	.	.	.	.	S G
W Agrostis *alba*	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S G
— borealis	.	.	—	—	—	—	—	—	—	—	—	?	—	.	.	.	A_2D
— canina	.	.	.	.	.	.	.	—	—	—	—	.	.	.	.	.	S G
Alopecurus alpinus	—	—	—	—	—	—	.	.	.	.	.	.	—	—	—	—	A_1C
— aristulatus	.	.	.	—	—	—	—	—	—	?	—	.	.	.	.	.	S G
W *Anthoxanthum odoratum*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S E
Arctagrostis latifolia	—	—	—	—	—	.	.	.	.	.	.	.	—	—	—	.	A_1D

W	Arctophila fulva	.	.	.	.	.	.	—	.	.	.	.	.	.	.	.	A_2C
	Calamagrostis arundinacea, var.	.	—	—	—	—	—	—	?	—	.	.	.	—	—	.	.	A_2D
W	— confinis (hyperborea)	.	.	.	—	—	—	—	—	—	.	.	.	.	.	.	.	S A
	— Langsdorffii	.	.	.	—	—	—	—	—	—	—	.	.	.	.	.	.	S D
	— neglecta	.	.	—	—	—	—	—	—	—	—	—	—	—	—	.	.	S G
	Catabrosa algida	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
W	— aquatica	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	.	S G
	Deschampsia alpina	.	.	.	.	.	—	—	—	—	—	—	.	.	.	.	.	S E
	— arctica	—	—	.	.	.	.	.	.	.	.	.	.	.	—	—	.	A_1A
	— flexuosa	.	.	.	.	.	—	—	—	—	—	—	.	.	.	.	.	S G
	— pumila	.	—	—	—	—	.	.	.	.	.	.	.	.	—	—	.	A_1A
	Dupontia Fisheri	.	.	—	—	—	.	.	.	.	.	.	.	.	—	.	.	A_1C
	Elymus arenarius, var.	.	.	—	—	—	—	—	—	—	—	.	.	.	.	.	.	S G
	Festuca ovina, var.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.	A_2G
	— rubra	.	.	—	—	—	—	—	—	—	—	—	—	—	—	.	.	S G
	Hierochloe alpina	—	—	—	—	—	—	—	—	—	—	.	.	—	—	—	—	A_2D
W	*Nardus strictus*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S E
	Phleum alpinum	.	.	.	.	—	—	—	—	—	—	—	.	.	.	.	.	S G
	Pleuropogon Sabinei	—	—	.	.	.	.	.	.	.	.	.	.	—	—	—	—	A_1C
	Poa abbreviata	—	—	—	—	—	.	.	.	.	.	.	.	—	—	—	—	A_1C
	— alpina	.	.	—	—	—	—	—	—	—	—	—	—	—	—	.	.	S G
W	— *annua*	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S E
	— arctica	—	—	—	—	—	—	—	.	.	.	—	—	—	—	—	.	A_1D
	— glauca	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
	— *nemoralis*	.	.	.	.	.	.	—	—	—	—	—	.	.	.	.	.	S G
	— pratensis s. l.	.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.	S G
	Puccinellia angustata	—	—	—	—	—	—	.	.	.	.	—	?	—	—	—	—	A_1C
W	— *maritima*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
	— phryganodes	—	—	—	—	—	—	—	—	—	?	—	—	—	—	—	.	A_2D
	— retroflexa, borealis	.	—	—	—	—	—	—	—	—	?	—	.	.	.	.	.	S G

Areas of the botanical districts	W.								S.			E.					
	83°-80° Lat. N.	80°-76°	76°?71°	71°-69°	Disko	69°-66°	66°-64°	64°-61°	61°-60°-61°	61°-65°	Angmagsalik	67°-70°	Scoresby S.	72°-76°	76°-81°	81°-83° Lat. N.	
District no.	VIII	VII	VI	Va	Vb	IV	III	II	I	II	III	IV	V	VI	VII	VIII	
W Puccinellia tenella	.	.	.	—	—	—	—	.	.	.	.	.	.	.	.	.	A_2C
— Vahliana	.	—	—	—	—	.	.	.	.	.	.	.	—	—	.	.	A_1C
Trisetum spicatum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
W Vahlodea atropurpurea	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	.	S D
Juncus arcticus	.	.	—	—	—	—	—	—	—	?	—	—	—	.	.	.	A_2G
— biglumis	—	—	—	—	—	—	—	—	—	?	—	—	—	—	—	.	A_2G
W — *bufonius*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
— castaneus	.	.	—	—	—	—	—	—	.	.	—	—	—	—	—	.	A_2G
W — *filiformis*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
W — *nodulosus*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
W — *squarrosus*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S E
— supinus	.	.	.	—	.	—	—	?	—	?	—	.	.	.	.	.	S G
— trifidus	.	.	.	—	—	—	—	—	—	—	—	—	—	.	.	.	S G
— triglumis	.	.	—	—	—	—	—	—	—	?	—	—	—	—	—	.	A_2G

	Luzula confusa	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	A_2G
	— frigida	.	.	—	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2D
W	— *multiflora*	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S G
	— nivalis	—	—	—	—	—	—	—	.	.	.	.	.	—	—	—	—	A_1D
W	— parviflora	.	.	.	.	—	—	—	—	—	.	.	.	.	.	.	.	S D
	— spicata	.	.	—	—	—	—	—	—	—	—	—	—	—	.	.	.	A_2G
	Triglochin palustre	.	.	.	—	—	—	—	—	—	?	—	.	.	.	.	.	S G
W	Streptopus amplexifolius	.	.	.	.	.	.	.	—	—	.	.	.	.	.	.	.	S C
	Tofieldia coccinea	.	—	—	—	—	—	.	.	.	.	.	.	—	—	—	.	A_1A
	— palustris	.	.	—	—	—	—	—	—	—	—	—	—	—	—	.	.	A_2G
W	Coralliorhiza trifida	.	.	.	.	—	—	—	—	—	.	.	.	.	.	.	.	S G
	Habenaria albida (straminea)	.	.	.	.	—	—	—	—	—	—	—	.	.	.	.	.	S G
	— hyperborea	.	.	.	.	—	.	—	—	—	—	—	.	.	.	.	.	S B
W	Listera cordata	.	.	.	.	—	.	—	—	—	.	.	.	.	.	.	.	S G
W	Orchis rotundifolia	.	.	.	.	.	.	.	.	—	.	.	.	.	.	.	.	S A
W	Potamogeton alpinus	.	.	.	.	.	—	—	—	.	.	.	.	.	.	.	.	S G
	— filiformis	.	.	.	—	—	—	—	—	—	?	—	.	.	.	.	.	S G
W	— gramineus	.	.	.	.	.	—	—	—	—	.	.	.	.	.	.	.	S G
W	— groenlandicus	.	.	.	—	—	—	—	—	—	.	.	.	.	.	.	.	S H
W	*Zostera marina*	.	.	.	.	.	.	—	.	.	.	.	.	.	.	.	.	S G
	Sparganium affine	.	.	.	.	.	.	—	.	—	.	—	.	.	.	.	.	S G
W	— hyperboreum	.	.	.	.	.	—	—	—	—	.	.	.	.	.	.	.	S G

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