

XII. *Notes on the Distribution of British Ferns.*

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EXCEPTING some spots of small extent, whence they are banished by local peculiarities of the surface, ferns may be said to range over the whole of Britain, from south to north, from east to west, and from the shores of the sea almost to the summits of the loftiest mountains; from which latter situation they are probably absent, rather in consequence of the bleak exposure to wind, than of the diminished temperature incidental to the height of any of our mountains.

The numerical value of the orders of plants, that are grouped under the general appellation of FERNS, in the Flora of Great Britain, will be estimated variously, according to the different views entertained with respect to the limits of species and varieties. The lowest estimate may be taken at 34; which is raised to 36, by the inclusion of two species now supposed to be extinct, and, perhaps, never found wild in England, namely, *Asplenium fontanum* and *Trichomanes brevisetum*. The majority of our botanists would probably divide the following four couplets into eight species, and thus raise the reputedly indigenous ferns to the number of 40; namely,

Polypodium Dryopteris and *calcareum*.

Aspidium lobatum and *aculeatum*.

Asplenium Ruta-muraria and *alternifolium*.

Cistopteris fragilis and *dentata*.

And the number of 40 would be still farther augmented by the addition of four other varieties, which are sometimes accepted for species, namely,

<i>Aspidium angulare</i> , a variety of <i>A. aculeatum</i> or <i>lobatum</i> .	
<i>Aspidium dilatatum</i> , ...	<i>A. spinulosum</i> .
<i>Aspidium dumetorum</i> , ...	<i>A. dilatatum</i> or <i>spinulosum</i> .
<i>Cistopteris angustata</i> , ...	<i>C. dentata</i> or <i>fragilis</i> .

There are some few botanists who would elevate *Aspidium recurvum* and *Asplenium irriguum* to the grade of species; and others would degrade *Cistopteris alpina* and *Woodsia hyperborea* to the subordinate place of varieties, and, perhaps, correctly; but since their views are not shared by many, we may hold our ferns to be estimated at 36, 40, or 44. And, according to the strictness with which doubtful species and doubtful natives may be excluded from an estimate of the flowering plants in this island, so of course will the proportion borne by ferns to flowering plants be made to vary. If we take a low estimate for one group, we must follow the same rule in the other, or their proportions will unavoidably appear wide of truth. By rigidly excluding all species not fully recognised as indigenous, and also numerous varieties which are commonly now counted amongst species, the flowering plants of Britain will be found scarcely to exceed 1200; or, admitting doubtful species, but still excluding doubtful natives, they may be taken at 1400. To reach the number of 1636, given in the Catalogue printed by the Botanical Society of Edinburgh, we must admit many species of foreign introduction, and a goodly list of varieties named and received as species. Setting these three different estimates of ferns and flowering plants against each other, we shall probably obtain a fair approximation to their true proportions, which will run thus:—

Ferns.	Flowers.	Proportions.
36	1200	1 to 33 $\frac{1}{3}$.
40	1400	1 to 35.
44	1636	1 to 37.

The following short table will show how far these agree with the proportions indicated by neighbouring islands and continental districts, fractions being disregarded.

	Ferns.	Flowers.	Proportions.
Iceland	14	357	1 to 25
Faroe.....	10	271	... 27
Ireland.....	33	1000	... 30
Channel Isles...	16	824	... 51
Belgium.....	26	1736	... 67
Zealand.....	21	983	... 47
Sweden.....	29	1165	... 40
Lapland.....	20	496	... 25

Ferns are thus seen to bear a larger proportion relatively to flowering plants, in the northern and mountainous parts of Western Europe, than is the case with this group of plants in low countries,—such as Belgium, Zealand, and the Channel Isles,—whose latitude nearly corresponds with that of England; whilst the proportions before set down for Britain place it in the scale betwixt Faroe and Iceland, on the one hand, and Belgium and the Channel Islands, on the other; the former having a relative predominance of ferns, the latter having a similar predominance of flowering plants.

The distribution of ferns within the limits of Britain itself, is found to be in accordance with what is thus shewn to be the case in the north-west of Europe generally; for the number of species diminishes both absolutely and also relatively to the flowering plants, as we pass from the hilly districts of Scotland and the north and west of England, towards the low south-eastern counties lying nearest to Belgium. The difference betwixt one fern for 25 flowering plants, (the proportion found in the Floras of Iceland and Lapland,) and one fern for 67 flowering plants, (the proportion shewn by the flora of Belgium,) seems considerable; and yet it will be found not much greater than the difference betwixt the proportions of ferns to flowering plants, in some of the English counties, one contrasted with another. As an illustration of this, the species of ferns have been counted in twenty of our most complete local Floras, and their number, and the proportions which they bear relatively to the flowering plants of the same Floras, are both set down in the annexed table:—

	Ferns.	Flowers.	Proportions.
Yorkshire.....	36	1002	1 to 28
Moray.....	20	610	... 30
Berwick.....	21	707	... 34
Glasgow.....	18	629	... 35
Anglesea.....	22	764	... 35
Devon.....	22	774	... 35
Tunbridge Wells.....	20	717	... 36
Northumberland, &c.....	28	1030	... 37
Midland Counties.....	23	840	... 37
Edinburgh.....	20	774	... 39
Bath.....	19	736	... 39
Nottingham.....	21	827	... 39
Aberdeen.....	14	560	... 40
Reigate.....	15	602	... 40
Liverpool.....	16	667	... 42
Oxford.....	16	727	... 44
Bedford.....	15	717	... 48
Yarmouth.....	14	724	... 52
Cambridge.....	14	847	... 60
Faversham and E. Kent.	13	806	... 62

A glance at this table will shew that the species of ferns are few in number, absolutely, and likewise relatively to the flowering plants, in the south-eastern counties of England; and that they become more numerous in the west, in the north, and especially in the hilly districts. York is pre-eminently the county of ferns. It has the largest number of species, which may in part be attributable to the greater size of the county, comparatively with the other districts, excepting that embraced by Purton's Flora of the midland counties; but as the phænogamic plants of Yorkshire would also increase in a ratio corresponding with the increase of area nearly, the single circumstance of greater size will not suffice to account for the high proportion which ferns bear to flowering plants within that county,—a proportion more than double that which is found in Cambridgeshire.

Various circumstances, doubtless, combine to give this predominance of ferns to Yorkshire; and these circumstances are aided by the author of the Flora of Yorkshire, who has multiplied species more than many other writers on local botany; for example, in enumerating four supposed species

of *Cistopteris*. But, independently of such augmentation, the species of ferns are most numerous in Yorkshire. The central position of the county is favourable to a varied Flora; the climate of its low vales being sufficiently mild for the growth of species which shun the northern counties of Scotland, without being too warm or dry for the growth of boreal species, to which the hilly districts of its western border are particularly suited, as well as to the production also of the more exclusively mountain species. Indeed, though not lofty, the hills of Yorkshire are still high enough for all or almost all the mountain ferns; and being much diversified with rocky dales, cascades, and swampy ground, they afford suitable localities for a tribe of plants, many of which are peculiarly adapted to grow in places where rocks, shade, and humidity can be united in various degrees. In addition, a line of sea coast brings our single fern of the shore, *Asplenium marinum*; whilst the variety of soil or rock further adapts the county to the production of the few species which seem decidedly to affect rocks of some particular mineralogical character.

On the contrary, Cambridgeshire presents a wide dissimilarity in the character of its surface, as in the number of its ferns. A large portion of this county consists of low fens, almost destitute of woods and hedgerows; and much of the rest is composed of gentle undulations of chalk, sparingly supplied with trees, and destitute of the well-watered dales that characterise some parts of Yorkshire; whilst their greatest elevation is inadequate to the production of mountain ferns.

Moray ranks next to Yorkshire in the high proportion of its ferns. But it will be observed by the table, that they are absolutely more numerous in some other districts, the proportion for Moray being somewhat raised in consequence of the rigid exclusion of introduced species of flowering plants, which have been carefully distinguished from the rest, by the author of the Moray Flora. On the contrary, the flowering plants enumerated in the Flora of Northumberland and

Durham are disproportionally increased by the addition of many species brought to the coasts of those counties in ship ballast; otherwise they would have come nearer to Yorkshire in the proportion of their ferns, to which county alone they rank second in respect of the absolute number of their species of ferns. But whilst local circumstances, both natural and artificial, may make some changes in the precise figures, the general result remains, as before stated, in an increase of ferns for the northern, western, and hilly counties of Britain.

This variation in the number of ferns of course implies, that some of the species must have only a partial range in the island; and, indeed, no one of the district Floras includes all the native species, whilst about half of these Floras include fewer than half of the species. Some species, however, are so widely diffused, and so abundant in individual specimens, that no doubt can be entertained respecting their existence in every county of Britain, although neither published records nor personal research may yet enable any botanist to make the assertion on actual evidence; more than it could yet be asserted, that the daisy and dandelion grow in every county, albeit none will make question of this assumed fact. Other species of ferns, on the contrary, are either limited to a few isolated localities, as is the case with *Woodsia ilvensis* and *Aspidium cristatum*; or have a wider range over a portion of the island, although absent from the southern, or northern, or eastern, or lowland counties of England or Scotland, as the case may happen to be. Of these latter, we have examples in *Polypodium Dryopteris* and *Cryptogramma crispa*. The rarity or frequency of the species is of course closely connected with these peculiarities.

In order to arrive at a more accurate estimate of the relative frequency of the species, with respect to Britain at large, than can be attained by the observations of any single botanist, an examination and comparison of the twenty district Floras, before alluded to, has been made; and the number of these Floras, in which each several species occurs, is set

down in the first column of figures in the annexed table. The same procedure has been followed with twenty-four manuscript lists, chiefly communicated by botanists resident in the districts to which the lists respectively refer; but several of these lists being either less complete, or relating to smaller tracts of country, they do not constitute so good a test of relative frequency as do the printed Floras, except in the case of mountain species, or of those which were ill understood at the dates of several of the older local Floras. The districts to which the printed Floras relate, may be seen in a preceding table. The manuscript lists are as follows:—Sussex, by the Rev. G. E. Smith; South Kent, by the same; East Grinstead by the Rev. W. H. Coleman; Esher, by Mr H. C. Watson; Hertford, by the Rev. W. H. Coleman; Dedham, by the same; Norfolk, by Miss Bell; West Leicestershire, by Rev. A. Bloxam; North Warwickshire, by Rev. W. T. Bree; Somerset, by Dr Southby; Bristol, by Miss Worsley; Denbighshire, by Mr J. E. Bowman; Derbyshire, by Dr G. Howitt; Leeds, by Mr H. Denny; Richmond, by Mr James Ward; Settle, by Mr John Tatham; Tees, by Mr John Hogg; Cumberland, by Mr H. C. Watson; Roxburgh, by Rev. J. Duncan; Eastern Grampians, by Mr H. C. Watson; Ross-shire, by Rev. G. Gordon; Sutherland, by Mr H. C. Watson; Orkney, by Dr Gillies, (also by Rev. C. Clouston); Isle of Man, by Mr E. Forbes.

	Floras.	Lists.	Both.
<i>Pteris aquilina</i>	20	24	44
<i>Polypodium vulgare</i>	20	24	44
<i>Aspidium Filix-mas</i>	20	24	44
<i>Blechnum boreale</i>	20	23	43
<i>Asplenium Adiantum-nigrum</i>	20	19	39
<i>Scolopendrium vulgare</i>	19	20	39
<i>Asplenium Filix-fœmina</i>	19	19	38
<i>Asplenium Trichomanes</i>	19	19	38
<i>Asplenium Ruta-muraria</i>	20	16	36
<i>Ophioglossum vulgatum</i>	18	16	34
<i>Aspidium Oreopteris</i>	17	14	31
<i>Aspidium lobatum</i>	15	14	29
<i>Botrychium Lunaria</i>	16	12	28

	Floras.	Lists.	Both.
<i>Aspidium aculeatum</i>	15	12	27
<i>Osmunda regalis</i>	15	9	24
<i>Aspidium dilatatum</i>	13	11	24
<i>Cistopteris fragilis</i>	11	8	19
<i>Polypodium Dryopteris</i>	9	10	19
<i>Asplenium marinum</i>	9	6	15
<i>Grammitis Ceterach</i>	7	8	15
<i>Aspidium Thelypteris</i>	11	3	14
<i>Aspidium spinulosum</i>	10	4	14
<i>Polypodium Phegopteris</i>	7	7	14
<i>Asplenium viride</i>	4	6	10
<i>Aspidium angulare</i>	2	8	10
<i>Aspidium Lonchitis</i>	3	6	9
<i>Cryptogramma crispa</i>	3	5	8
<i>Hymenophyllum Wilsoni</i>	2	6	8
<i>Hymenophyllum tunbridgense</i>	4	2	6
<i>Aspidium cristatum</i>	5	1	6
<i>Cistopteris dentata</i>	3	2	5
<i>Polypodium calcareum</i>	3	1	4
<i>Asplenium septentrionale</i>	1	3	4
<i>Woodsia ilvensis</i>	2	1	3
<i>Aspidium dumetorum</i>	1	2	3
<i>Asplenium lanceolatum</i>	1	1	2
<i>Aspidium rigidum</i>	1	0	1
<i>Cistopteris alpina</i>	1	0	1
<i>Asplenium alternifolium</i>	0	1	1
<i>Woodsia hyperborea</i>	0	0	0
<i>Adiantum Capillus-Veneris</i>	0	0	0
<i>Asplenium fontanum</i>	0	0	0
<i>Trichomanes brevisetum</i>	0	0	0

For a few of the species, this table might give erroneous ideas of relative frequency, should the figures alone be taken into account, without regard to the distinctness of the species, the dates of their first discovery, and the certainty of their nomenclature. Thus, *Aspidium spinulosum* and *dilatatum* occur too low in the list, in consequence of some botanists uniting them into one species, sometimes the one name, sometimes the other, being applied to the united varieties. *Aspidium cristatum* appears in some of the printed Floras through a misnomer; and *Hymenophyllum Wilsoni* was long overlooked by botanical writers. The former consequently comes too high, the latter too low in the scale of relative frequency.

It will be observed, that only three species are so univer-

sally distributed as to be included in all the forty-four district Floras and lists, namely, *Pteris aquilina*, *Polypodium vulgare*, and *Aspidium Filix-mas*, which are unquestionably the three commonest of our indigenous ferns; and should we reckon up the extent of surface occupied by these three species, it would probably be found to exceed that occupied by all the other species taken together. Indeed, could we count the number of square yards covered by each species, or the number of individual fronds, it is likely that *Pteris aquilina* might be found to exceed all the other ferns united, without excepting the other two species just named as amongst the three commonest species.

Yet it is not amongst these three ferns that we shall find those species which have the widest geographical range in Britain. Although spread from one end of the island to the other, and found in almost every county in the greatest profusion, yet they cease to grow on the mountains at a height that is greatly exceeded by some other species, which are scattered as widely in the low grounds also, though not so numerous as the three very common species above named. The most widely ranging of our native ferns, taking into view the three directions of latitude, longitude, and elevation, are *Blechnum boreale* and *Aspidium dilatatum*; (or *spinulosum*, for it is difficult to say which name should be applied to the boreal and alpine form of this species.)

It has been already stated, that ferns prevail chiefly in the hilly tracts towards the north and west, and that they are less numerous in the low south-eastern counties of England,—a peculiarity that is doubtless in great measure attributable to the more humid and cooler atmosphere of the former. The three circumstances on which this difference of climate depends, are those of latitude and longitude, conjointly with elevation of the surface; and the influence of these three conditions in producing the general result, will scarcely admit of divided consideration. We may, indeed, trace some agreement betwixt the range of certain species and the geographical divisions of latitude and longitude; yet this connexion (or, more strictly, this coincidence) is so

much interfered with by the third condition, that of height, as to render separate investigation almost useless.

About one-half of our indigenous ferns are entirely absent from those counties of England that lie to the eastward of Gloucestershire and Nottinghamshire; whilst none of the species found growing in these south-eastern counties are wholly wanting in those to the westward of them; most of these species also being much more plentiful in the western counties. But it is less to the mere effect of longitudinal position, than to the character of the surface, that we must attribute the paucity of ferns in the south-eastern counties. The absence of rocky ravines, of waterfalls, and of mountain elevations, and the consequent dryness of atmosphere, will account for the comparative scarcity of ferns, far more satisfactorily than the mere difference of longitude, apart from the changed character of the surface.

Again, though we may trace northern or southern limits for several species more decidedly than their limits can be traced longitudinally, yet we shall still find, that it is the hilly and broken character of the surface, and not merely the degree of latitude, that determines their lines of cessation. Thus, the hills of Wales bring several species into a more southern latitude than it is at all likely they would have been found in, if Wales and the adjacent English counties had been as little diversified with high hills as are the counties under the same latitude on the eastern side of the island. The effect of the mountains, however, is probably much more decidedly shewn in prolonging the southern range, than in arresting the northern range of ferns; since the low coast line, as well as small plains and valleys around, or amongst the hills, may still afford suitable localities for such ferns as are unfitted to bear the climate of the mountain summits or acclivities, although capable of growing in the climate incidental to the latitude.

The following twenty species may be considered to have a range of latitude almost through the whole of Britain, being found in the counties southward of the Thames and Bristol Channel, and also in those lying northward of the Grampian

mountains; occurring likewise plentifully in the intermediate tracts:—

<i>Cistopteris fragilis.</i>	<i>Aspidium lobatum.</i>
<i>Polypodium Phegopteris.</i>	... <i>Oreopteris.</i>
... <i>vulgare.</i>	... <i>Filix-mas.</i>
<i>Pteris aquilina.</i>	... <i>spinulosum.</i>
<i>Blechnum boreale.</i>	... <i>dilatatum.</i>
<i>Botrychium Lunaria.</i>	<i>Asplenium Filix-fœmina.</i>
<i>Ophioglossum vulgatum.</i>	... <i>Trichomanes.</i>
<i>Osmunda regalis.</i>	... <i>Ruta-muraria.</i>
<i>Scolopendrium vulgare.</i>	... <i>Adiantum-nigrum.</i>
<i>Hymenophyllum Wilsoni.</i>	... <i>marinum.</i>

Four of these are very rare in the south of England, namely, *Botrychium Lunaria*, *Cistopteris fragilis*, *Hymenophyllum Wilsoni*, and *Polypodium Phegopteris*, especially the last; and they are not found at all in the Channel Isles. On the other hand, four are decidedly rare in the north of Scotland, namely, *Asplenium marinum*, *Scolopendrium vulgare*, *Ophioglossum vulgatum*, and *Osmunda regalis*; and they are not found at all in the Faroe isles, though the *Ophioglossum* is stated to grow in Iceland. Thus, out of twenty species which have the most general range of latitude with us, eight seem to be already yielding before an unsuitable climate at one or other extremity of the island. The rest of our native ferns have their latitudinal extension arrested either in the south or in the north, or, in some instances, in both directions. As boreal and mountain ferns, which are unknown southward of the Thames, we may enumerate the following:—

<i>Woodsia hyperborea.</i>	<i>Asplenium viride.</i>
... <i>ilvensis.</i>	... <i>septentrionale.</i>
<i>Cistopteris alpina.</i>	<i>Aspidium Lonchitis.</i>
... <i>dentata.</i>	<i>Cryptogramma crispa.</i>
<i>Polypodium Dryopteris.</i>	

And as other species equally absent from the extreme south of England, but confined to the middle latitudes of Britain, rather than evincing any special predilection for the northern and mountainous districts, we have these four:—

Aspidium cristatum.
... *rigidum.*

Asplenium alternifolium.
Polypodium calcareum.

On the contrary, four other species decidedly affect the southern, or the southern and midland counties, being absent from the northern counties, namely,—

Adiantum Capillus-Veneris.
Asplenium lanceolatum.

Aspidium Thelypteris.
Grammitis Ceterach.

And to these four we should perhaps add as many others, whose range is undetermined, or whose specific distinctness is very questionable, namely,—

Hymenophyllum tunbridgense.
Aspidium aculeatum.

Aspidium angulare.
... *dumetorum.*

Two remaining species, if ever found in England, and not now extinct, are exceedingly local in the north of England :

Asplenium fontanum.

Trichomanes brevisetum.

With regard to the limits of ferns in ascending the mountains, we yet require more complete and accurate observations. Indeed, scarcely any thing has hitherto been published on the subject, except some notes on the heights attained by a few of the species, which were communicated to Mr Francis, for his "Analysis of British Ferns." But since the loftiest of our mountains are destitute of ferns on their extreme summits, as was before remarked, all the species must have lines, or points of cessation, either upon or towards the mountain ranges. Five species certainly rise almost to the summits of the highest hills in Scotland, namely,—

Cryptogramma crispa.
Blechnum boreale.
Polypodium Phegopteris.

Aspidium (dilatatum?)
... *Lonchitis.*

These five are found in various spots, whose absolute elevation runs between 3000 and 4000 feet; and possibly the *Blechnum* and *Cryptogramma* may exceed 4000 feet. At a lower elevation, but still probably above 2000 feet, and some perhaps above 3000 feet, we have the following,—

Botrychium Lunaria.
Woodsia hyperborea.

Woodsia ilvensis.
Asplenium viride.

Cistopteris alpina.
... *dentata*.

Cistopteris fragilis.
Polypodium vulgare.

On the lower declivities of the mountains, that is, below 2000 feet, we still find these (unless *Woodsia hyperborea* and *Cistopteris alpina* be exceptions), and also almost all the remaining ferns, very few of which are wholly absent from the mountain districts, though we may perhaps say that *Adiantum Capillus-Veneris*, *Asplenium lanceolatum*, and *Asplenium marinum* are so. Indeed, the bases of the mountains, and their intervening valleys, are the head-quarters of the ferns; for most of the species that grow in the low south-eastern counties of England, do also grow about the bases of the mountains in Wales, and the north of England; whilst, on the contrary, none of the mountain ferns are so exclusively alpine, as not to descend below 2000, or even below 1000 feet, if we except the two *Woodsias* and *Cistopteris alpina*. The stations for the latter, in the hilly districts, may all be above 1000, or even 2000 feet; but its occurrence in Essex, (if that can be called a native habitat) shows this species to be not rigidly limited to high places as a wild plant. The Clova station for a *Woodsia* (*ilvensis* or *hyperborea*, as may be decided), is certainly below 2000 feet. *Aspidium Lonchitis* is rarely seen below 1000 feet, though frequently found below 2000 feet of absolute height. But these species do not grow on isolated hills of 2000 feet or less, remote from those of greater elevation, although found at such heights on the flanks of the loftier mountains. On quitting the mountain tracts, we leave the four following species behind us:—

Woodsia hyperborea.
... *ilvensis*.

Aspidium Lonchitis.
Asplenium viride.

And two others are so rare upon lower hills isolated from the mountain districts, that they might be classed along with the mountain ferns, with little violence to nature, namely,—

Cryptogramma crispa.

Asplenium septentrionale.

Eight other species, though chiefly found in the hilly districts

of the north and west, are occasionally seen in situations so far from the mountain tracts, that they cannot be held in the character of exclusively mountain ferns, namely,—

Cistopteris alpina.	Polypodium Phegopteris.
... dentata.	... Dryopteris.
... fragilis.	... calcareum.
Hymenophyllum Wilsoni.	Botrychium Lunaria.

Under the combined influence of latitude and longitude, thus modified by the effect of elevation of surface, the lower limits of many ferns, equally as those of flowering plants, appear on a map like irregular lines, whose general direction runs from south-west to north-east; whilst their upper limits encircle the hills, or the hilly tracts, like zones or belts. Plants do not, indeed, really terminate in lines after this fashion, but in isolated spots, which gradually become more and more distant from each other, as we approach the places where they finally cease to grow; and it is only artificial lines drawn on a map, so as to connect the extreme stations for any species in either direction, that the botanical geographer can intend when he speaks of the terminal lines of plants.

It is scarcely necessary farther to explain, that in using the terms *lower* and *upper* limits or lines, they must be understood to apply to latitude, to elevation above the sea level, and also in some measure to the degree of proximity to the mountain tracts. Everybody who has studied the distribution of plants in the dominions of nature, and not in books solely, must be well aware that a great change will be seen in a Flora as we approximate to the mountain tracts, although the latitude and absolute elevation have still continued nearly the same. Hence, when the *upper* limits of plants in Britain are spoken of, the expression will be understood, if not otherwise qualified, as including three principal conditions in physical geography, namely, more northern latitude, increased elevation, and greater proximity to the mountain tracts or centres. On the contrary, the *lower* limits will signify the opposite conditions of southern latitude, diminished elevation, and also comparative remoteness

from the mountain tracts, as centres around which the species are distributed.

Keeping in recollection these explanations touching the lines or limits of plants, botanists will understand the writer of this paper when he says, that it is at present impossible to draw maps, accurately illustrating the distribution of plants in Britain, in consequence of the upper limits of most of the species being yet so little known. It would not be difficult to trace the upper limits in latitude for most of our native plants, whether ferns or flowers, with tolerable accuracy. This might also be done approximately in respect of altitude above the sea level. But the propinquity of most of the species to the mountain centres, has still to be ascertained. Botanists often observe and record the spots where mountain species are first met with by them, when journeying from the open plains towards the hilly tracts; but seldom do they either record or notice the places where the species of the plains are last seen, as they enter amongst the valleys of the mountain districts. Besides this, a large proportion of the printed records of localities, specify the places in such general terms, that they cannot be marked on a map.

As an example of such difficulties, let us take *Scolopendrium vulgare*, a fern widely diffused in Britain, from Orkney to the Isle of Wight, and abundant in the south of England. Betwixt these extreme points, however, there are many wide spaces from which this fern is wholly absent; and one of these spaces perhaps includes nearly the whole of the Highlands. The *Scolopendrium* is reported to grow in the counties of Renfrew, Lanark, Edinburgh, Forfar, Nairn, and Orkney, and thus seems partially to encircle the Highlands. But whether its extreme stations, or upper limits towards the mountain centres, are found in these counties, remains to be shewn. Again, *Pteris aquilina* is exceedingly plentiful in Britain, from one extremity to the other; but it fails upon the higher hills of Wales, the north of England, and the Scottish Highlands; and may even prove to be wholly absent from a transverse belt of high

moors and hills crossing Scotland about the 57th parallel of latitude. But what botanist can trace on a map of Britain those portions of the surface from which this very conspicuous fern is quite absent?

To convey any accurate idea of the local distribution of plants, maps on a large scale would be required, and also a separate map for almost every species. Such maps could now be made, though they would unavoidably contain numerous blank spaces, where it is yet unknown whether certain species do or do not grow. But to engrave a distinct map for each species of plant, is quite impossible, on account of the expense; and the only remedy for this impediment to publication, must be obtained by the use of one engraved map, to which colours can be added by the hand, a separate copy being taken for each species; one colour being spread over tracts where the species is known to grow; a second colour being used for spaces where there is good ground for assuming the species to be wholly wanting; the rest of the surface remaining blank, until further knowledge points out which of the two colours should be applied to it. But since the multiplication of these coloured maps could be made only by hand-labour in copying from an original, they could never be published except at such a price as would almost entirely preclude purchase. It has been asked, why botanical maps cannot be engraved like geological maps, and afterwards coloured in accordance with the engraved lines? It is the necessity of engraving a separate map for each species, that prevents this course. Plants are not distributed like geological formations, one occupying usually a great extent of surface, to the exclusion of all others; for a square yard of ground may have on it a dozen different species of plants, and a square mile may have its scores, not to say hundreds, of species. At some future day, the writer of this paper hopes to deposit in the library of the Edinburgh Botanical Society, a series of such maps as it is possible to construct on our existing knowledge; but, if he can carry this wish into effect, the maps must be of such a size, and so numerous, as to forbid all idea of publication.

In returning from this digression respecting maps, to the immediate subject of the present paper, it may be farther observed, that ferns, as a class of plants, cannot be exclusively connected with any particular local situation or quality of soil. For the most part, a shady situation, damp ground and atmosphere, and a porous or peaty soil, are suitable to ferns; whilst exposure to sun, wind, and salt spray, as well as very dry or marshy localities, are unsuitable. But some of the *Asplenias* grow in dry crevices of rocks and walls, as also do *Grammitis Ceterach*, *Polypodium Dryopteris*, and *Polypodium calcareum*, and even the less rigid ferns constituting the genus *Cistopteris*. On the contrary, *Osmunda regalis* might almost be designated a marsh fern; and other species so far approximate to the same character, as to thrive in swampy ground, that is, in watery places, where the soil is loose and spongy; for example, *Aspidium Thelypteris*. But ferns that grow well in swampy places, will also grow well on rocks and banks where the soil is not particularly wet; for instance, *Blechnum boreale* and *Asplenium Filix-femina*. None are aquatics. One only is a littoral species, *Asplenium marinum*; and this one is occasionally seen in places many miles from the sea. *Osmunda regalis* so frequently occurs near the shore, within reach of the salt spray, and even at times within reach of high tides, that it might be regarded as a sub-littoral species. None perhaps require the sun's rays directly shining upon them; but some few will bear daily exposure to the sun for several hours, though the greater number thrive best on a slender allowance of sunshine. It cannot yet be stated that any species are absolutely limited to soils of a particular chemical or geognostic character; but *Grammitis Ceterach*, *Polypodium calcareum*, and the species of *Cistopteris*, certainly affect lime rocks, though, indeed, it is believed by some botanists, that the *Polypodium calcareum* is a variety of *P. Dryopteris*, varied in its habit through the influence of soil or exposure. If so, the only species that is limited to limestone, if even it be so limited, is *Grammitis Ceterach*. The harder kinds of trap and slate rocks seem favourable to *Asplenium septen-*

trionale and *Woodsia ilvensis*. And in general the sandstones are more productive of ferns than chalk or clays; though the difference here is probably owing more to the mechanical than to the chemical qualities of the soils.

I have been induced to address these notes to the Botanical Society, to supply obvious deficiencies in some recent, and otherwise very beautiful works on the ferns of this country; but whose authors have evidently been little acquainted either with the relative frequency of the species, or with those peculiarities of habitat and extension which are comprehensively designated by the term of *Geographical Distribution*. And having myself omitted the ferns, in my printed volumes on the localities and geographical distribution of plants, the subject has hitherto remained almost untouched, excepting so far as the printed records of stations for the rarer ferns, in our descriptive Floras and local catalogues, may be held to bear upon it.