

THE DISTRIBUTION MAPS SCHEME

By S. M. WALTERS

HISTORY OF THE PROJECT

The collection and publication of data on the distribution of British plants has been a major activity of our Society from its earliest days, and the interpretation of these data in the study of plant geography has always interested the members, both amateur and professional. This interest was well shown at the Society's very successful second Conference which met in April 1950 to consider the whole field of the study of the distribution of British plants in the light of the requirements of modern botanical science. *The Times* (12 April 1950) devoted a fourth leader to some aspects of the work of this Conference under the title of 'Mapping the Cat's Ear'.

The Conference Report, edited by J. E. Lousley and published in 1951, made available in convenient form the papers, illustrations and discussions, and stimulated further interest amongst British botanists as a whole.

At the closing session of the 1950 Conference, Professor A. R. Clapham had put forward a detailed proposal for a scheme to prepare and publish a set of distribution maps of the British flora, and a resolution was passed asking the Council of the Society to discuss the possibility of preparing and producing such a series of maps. The Council, accordingly, discussed Professor Clapham's suggestion at a meeting in May 1950, and appointed a Committee to consider the part the Society might play in the project. This Maps Committee consisted of:—

Professor A. R. Clapham
Mr. J. E. Lousley
Mr. E. Milne-Redhead
Professor T. G. Tutin
Mr. E. C. Wallace
Dr. E. F. Warburg

and at its first meeting, Mr. Lousley was elected Chairman and Professor Clapham, Secretary. Much careful investigation of the practical difficulties followed, and members undertook experimental mapping of a number of species from the existing records to reveal inadequacies of data and of methods of representation. Early in 1953 the Committee felt sufficiently sure that, given adequate financial support, the project to prepare and publish an atlas of distribution maps of British vascular plants was a practical one and, accordingly, an approach was made to the

Nuffield Foundation for a grant for a five years' project. This approach was successful, and the offer of a grant of £10,000 for the Scheme was gratefully accepted by the Council in December 1953. The Council further appointed myself as Director of the Scheme, which was to be centred in Cambridge, where facilities were available in the Botany School through the co-operation of the Professor of Botany and the General Board of the University. The Maps Committee was re-formed and enlarged, with power to co-opt representatives of other bodies, and the Council accepted its recommendation to appoint Mr. F. Perring as full time Senior Worker from 1 October 1954, and Miss A. Matthews as full time Secretary from 6 April 1954. The 'Maps Office' thus came into being just before the Scheme was officially launched at the Society's Conference on April 9 and 10, 1954—exactly four years after the foundations were laid. Public acknowledgment was made of the generous grant of the Nuffield Foundation, and of valuable financial assistance from the Nature Conservancy, in the form of a grant of £1,000 per annum for the four years of the Scheme (commencing April 1955), and the cost of the Powers-Samas punched-card recording system adopted by the Committee for the incorporation of the vast body of data and the automatic production of maps. At the end of the Scheme, the Conservancy will take over the machinery, and the punched cards, as the basis of a permanent recording system.

At the April Conference it was possible to demonstrate the system of incorporating data and 'mechanised mapping'; in addition, Professor Clapham and I outlined the history of the project and the part field botanists could play in it. What follows is largely an expansion of the talks and demonstrations given on this occasion.

OUTLINE OF METHOD

The basis of the scheme is to indicate by means of a conventional symbol the presence of each species of vascular plant in each 10 kilometre square of the Ordnance Survey National Grid, thus producing a distribution map of the species concerned. The National Grid does not cover Ireland; we have had to extend it backwards from the N-S baseline (which, roughly, bisects Ireland). There are roughly 3,500 such squares on the map of the British Isles and it is hoped to map some 2,000 species. Assuming each species to be present in roughly one-third of the squares, some 2,500,000 individual records will have to be assembled and transferred to maps. This will be done in the following way:—

A small 40-column punched card (fig. 1) will be prepared for *each record*. It will carry, as 'essential information', the following data:—

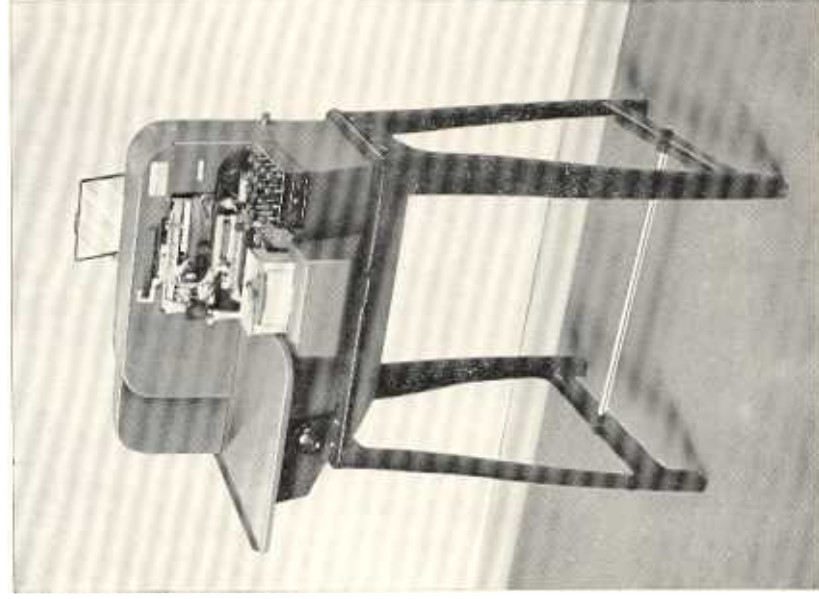
- (a) the 'code number' of the species (each species is assigned a serial code number for the purposes of the scheme). (Columns 1-4).
- (b) the date of the record (*at least* the year). (Columns 5-7).
- (c) the National Grid Reference of the locality (*at least* to the 10 kilometre square (e.g. 52/41); if available, in more detail (e.g. 52/4010 or 52/400100)). (Columns 8-15).
- (d) the vice-county number. (Columns 16 and 17).

In addition, columns 18 and 19 have been assigned for data which, though not absolutely essential to mapping, are valuable and relatively easily obtained; column 18 is for altitude (in 100') and 19 for a coarse habitat classification (12 major types, e.g. woodland, aquatic, etc.). The remaining 21 columns of the card are not yet assigned; they are available for the Nature Conservancy's permanent recording scheme.

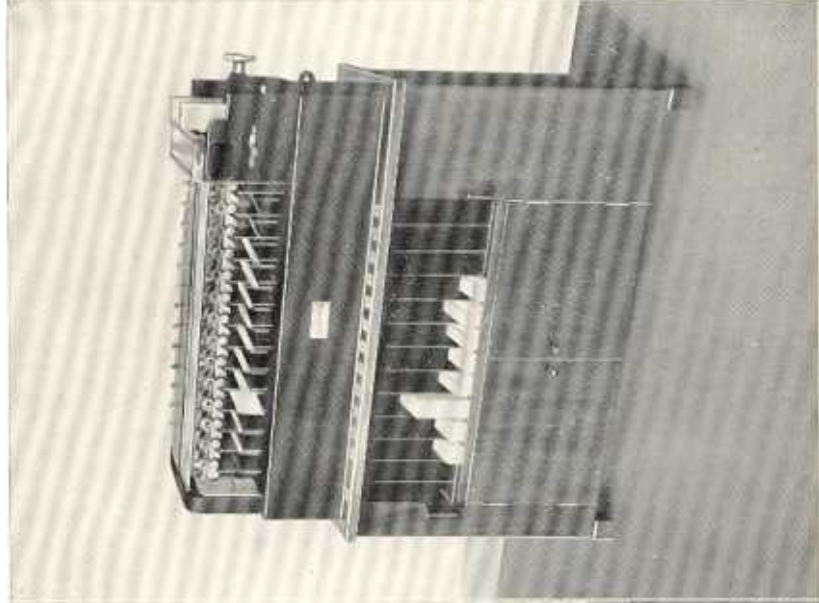
The punching of the card (done on an *automatic key-punch*, resembling a typewriter (fig. 2a)) transfers the data to the card in the form of holes, each hole indicating a particular digit (1-9). The face of the card is occupied by compartments for written data, and from which the required information for punching can be obtained; it is thus a 'dual purpose' card, and an individual record (e.g. from a herbarium sheet) can be transcribed directly on to it (figs. 1a and 1b).

Data will also be available in the form of *lists* of species made at the same locality at the same date; for these the system has the great advantage that information (e.g. grid reference) common to all the species can be punched *automatically* on all the cards in one operation. It is thus apparent that large, reliable lists constitute the most rewarding type of data for the scheme.

All the punched cards referring to a particular species (e.g. *Lamium album*) will carry the same code number (1098); they can therefore be sorted mechanically for this number, with the aid of the second piece of essential machinery, *the sorter* (fig. 2b), at a speed of 40,000 per hour. Similarly, if it is required, all the cards bearing, e.g., the same 10 kilometre Grid Reference (e.g. 52/41) can be sorted out. Finally, packs of cards for a particular species are sorted into sequence of Grid Reference, and given to the largest machine, *the tabulator* (figs. 2c and 2d), which transfers each 10 kilometre Grid Reference on to a base-map as a symbol, at a rate of about 100 per minute. In this way, a complete map (fig. 3) can be tabulated automatically in about half an hour. Mechanical map tabulation is, incidentally, so far as we are aware, an entirely new departure; and owes its existence to the ingenuity and enthusiasm of the representatives of Powers-Samas, who converted our tentative suggestions into reality with remarkable promptitude.

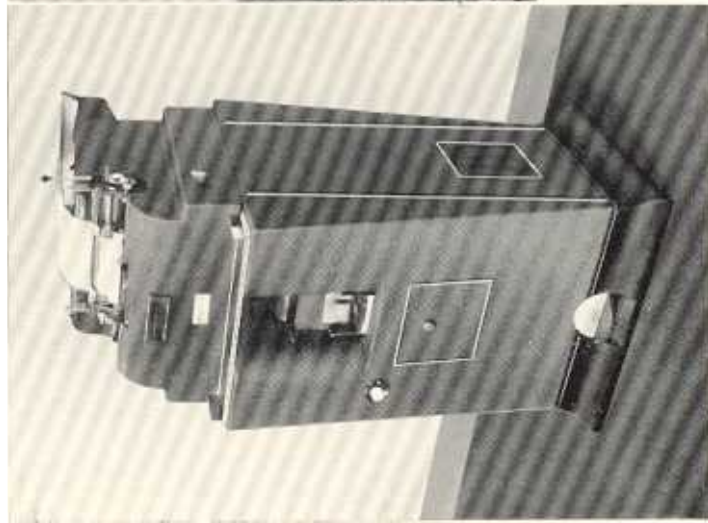


2a. AUTOMATIC KEY-PUNCH



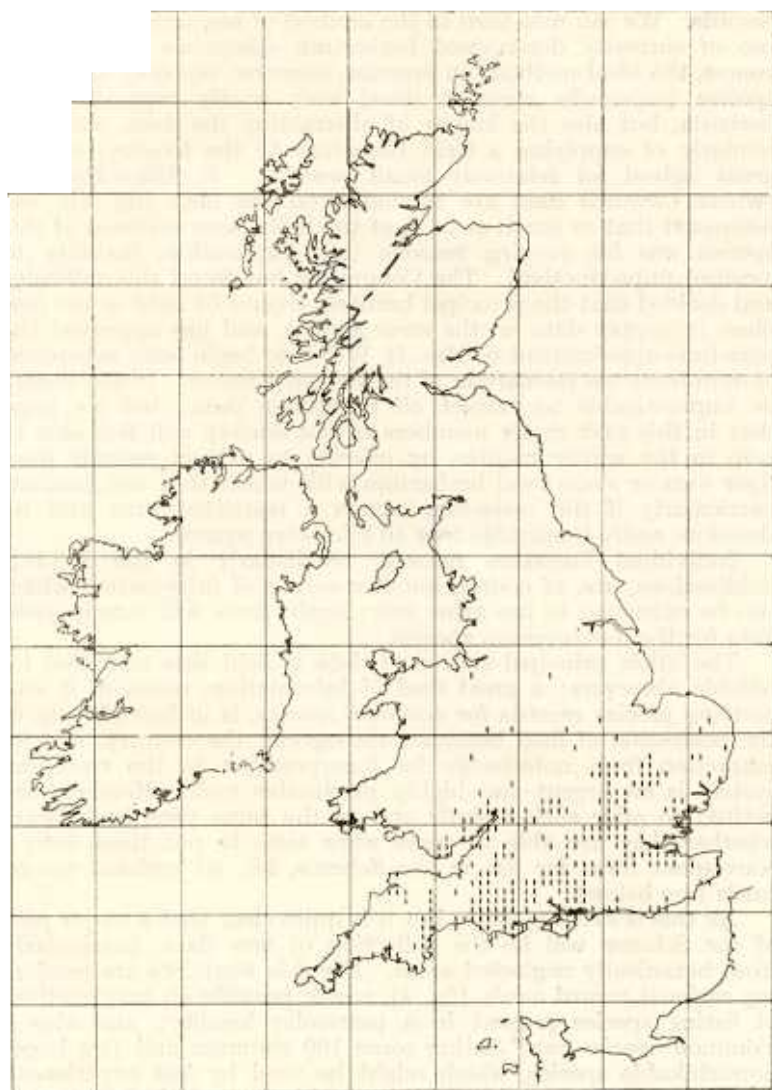
2b. SORTER

PLATE 3



(Above) 2d. TABULATOR PRODUCING A MAP AT THE APRIL
CONFERENCE DEMONSTRATION

(Left) 2c. TABULATOR



3. TABULATED MAP OF DISTRIBUTION OF *Clematis vitalba* L.

(DATA SUPPLIED BY E. MILNE-REDHEAD.) [This map is given as an example, and should not be taken as representing the known distribution.]

So much for the mechanics of assembling and using the records. We can now turn to the method of acquiring data. The use of correctly determined herbarium specimens provides, of course, the ideal method; in practice, however, not only are many species (especially common ones) very poorly represented in herbaria, but also the labour of abstracting the data, and particularly of supplying a Grid Reference to the locality, is very great indeed for relatively small reward. E. Milne-Redhead (whose *Clematis* data are tabulated on the map (fig. 3)), has estimated that as much as 95% of the herbarium material of this species was for varying reasons (e.g. duplication, inability to localise) unproductive! The Committee has faced this difficulty and decided that the principal herbaria should be used in the first place to supply data on the *rarer* species, and has approved the part-time appointment of Mrs. B. Welch to begin such extraction of data from the Herbarium of the British Museum. It will clearly be impracticable to extract *all* herbarium data; but we hope that in this task many members of the Society will feel able to help in the winter months by offering to extract records from their own or some local herbarium with which they are familiar, particularly if the collection covers a restricted area and is, therefore easily localisable to a 10 kilometre square.

Individual literature records, particularly in the B.S.B.I. publications, are, of course, another source of information which can be extracted in the same way; again these will mostly yield data for the less common species.

The other principal source of data is field lists compiled by reliable observers; a great deal of information, much of it embodying precise records for *common species*, is in fact already in the possession of field botanists throughout the country, and its extraction from note-books for incorporation in the recording system is an urgent and highly productive task. Members are invited to offer such records and at the same time to indicate whether they are able to spare some time to put these into a convenient form for use in the Scheme, i.e., on regional record cards (see below).

All this is *existing data*; but it is quite clear that a major part of the Scheme will be the collection of new data, particularly from botanically neglected areas. For this work, we are producing regional record cards (fig. 4), which provide an easy method of listing species present in a particular locality; and also a 'common species card' listing some 100 common and (we hope) unmistakable species, which might be used by less experienced workers. Experience already gained with the use of similar cards in County Flora Schemes (e.g., Cambridgeshire, Derbyshire) has proved their extreme value for simple recording. Members able to produce data in this way are invited to offer their services; in particular a commitment to work in a specified 10 kilometre square is of great value.

MAPS SCHEM

Grid Ref. 1264-619	LOCALITY	Chippenhams Fen	
	HABITAT	Rough grassland	
	SOUTH EAST		
	Date	V.C. No.	
	7.1945	29	
	V.C.	Camb	
	Alt.	Code No	
	301	100	

3 Acer catn	207 Astra dan	361 Carex dein	538 Colch aut	771 Eupho exi	961 Helic pra
6 Acer pse	208 gly	363 dia	540 Coniu mac	772 hel	962 pub
6 Acer ant	211 Athyr ni	366 dista	541 Conop maj	777 peplu	968 Herac sph
7 Achil mai	212 Atrip gla	367 disticha	544 Convo arv	2213 Euphr agg	976 Hierac pil
12 Acino arv	214 bas	368 divisa	548 Cornu san	783 ang	979 Hippo com
15 Acoru cal	217 lit	369 divulsa	550 Coron var	798 ang	980 Hippo rha
19 Adoxa mos	218 pat	370 ech	551 Coron did	801 pse	981 Hippu vul
20 Aegop pod	216 sab	371 ela	552 squ	804 ros	983 Holcu lan
221 Aescu bip	220 Avena fat	373 eri	555 Coryd cla		984 mol
21 Aethu cyn	221 lud	374 ext	556 lut		988 Honke pep
22 Agrim eup		376	557 Coryl ave	810 Fagus syl	989 Horde eur
23 odo	224 Balde ran	381 hur	569 Crata mon	813 Festu are	991 Horde mar
26 can	225 Ballo nig	382	570 oxy	816 gig	992 mur
28 jun	229 Barba vul	385 lae	571 Crepi bie	821 ovi	993 sec
32 pun	231 Berbe per	386 las	572	823 pra	995 Hotto pal
33	232 Berbe vul	387 lep	578 tar	824 rub	996 Humul lup
35 Agros can	234 Berul ere	393 nig	588 Cuscu epi	830 Filag	998 Hydro mor
36 gig	235 Beta mar	396 otr	589 epith	831 min	999 Hydro vul
39	240 Betul pub	397 ova	592 Cymba mur	833 Filip	1003 Hyper and
40 ten	239	398 pai	596 Cynog off	834 vul	1004 cal
41 Aira car	241 Biden cer	399 pai	597 Cynos ori	835 Foeni vul	1006 dub
42 pra	242 tri	400 panicea		836 Fraga ana	1008 elo
46 Ajuga rep	243 Black per	401 panicula	607 Dacty glo	838 ves	1010 hur
57 Aiche ves	244 Blech spi	404 pen	617 Daphn lau	839 Frang aln	1011 hum
60 xan	245 Blysn com	405 pil	620 Dacty glo	841 Fraxi exc	1014 per
62 Alism lan	248 Botry lun	406 pol	627 Dacty glo	847 Fumar cap	1015 oul
63 pla	249 Brach pin	407 pse	628 fle	849 mic	1016
64 Allia pet	250 syl	408 pul	630 Descu sop	854 off	1018 Hypoc gla
75 Alliu urs	251 Brass nap	412 rem	434 Desma mar	856 par	1020
76 vin	252 nig	413 rip	435 rig	858 vai	
77 Alnus glu	253 ole	414 ros	640 Digit pur		1022 Iberi ama
79 Alope aeq	254 rap	419 ser	644 Diplo mur		1023 Ilex aqu
82 gen	256 Briza med	421 syl	645 ten	862 Galeo lut	1030 Inula con
	258 Bromu arv	424 ves	646 Dipsa ful	863 Galeo	1036 Iris fo

FOLD HERE																
84	myo	262	com	427	Carli	vul	647	pil	867	spe	1038	pse				
85	pra	268	lep	428	Carpi	bet	657	Drose	rot	868						
87	Altha	off		432	Casta	sat	661	Dryop	aus	871	Galin					
97	Amnopo	are	270	*mol	433	Catab	aqu	*fil	873	apa	ang	1048	Jasio	mon	acu	
98	Anaca	pyr	271	rac	440	Centa	cya	spi	875	eru	1050	Juncu	acu			
99	Anaga	arv	273	sec	444				875	cru	1054	art				
100	ten	275	tho	446	sca				877	ere	1057	buf				
105	Anemo	nem	276	Bryon	dio	451	Centa	min	670	Echiu	vul	878	her	1058	*bul	
106	pul	288	Butom	umb	453	pul	673	Eleoc	aci	879		*mol	1062	com		
109	Angel	syl			456	Centu	min	674	mul	880	mol	1063	con			
113	Anisa	ste	291	Cakil	mar	457	Cepha	dam	675	pal	882	pal	1067	eff		
117	Anthe	arv	292	Calat	can	461	Ceras	arv	677	pau	886	tri	1069	ger		
118	cot	293	epi	466	glo	678	uni	887					1070			
121	Antho	odo	296	Calam	asc	469	sem	679	Eleog	flu	888	ver	1072	mar		
123	Anthr	neg	298	nep	462	tet	681	Elode	can	891	Genis	ang	1075	com		
125	syl	303	Calli	int	467	ver	682	Elymu	are	883	tin	1076				
126	Anthy	vul	304	obt	471	Cerat	dem	687	Endym	non	897	Genti	*ama	1077	ten	
128	Antir	oro	307	sta	474	Chaen	min	688	Epilo	ade	906	Geran	coi	1080	Junip	com
131	Aphan	*arv	305	ver	476	Chaer	tem	689	adn	907			dis			
132	arv	309	Callu	vul	477	Chama	ang	692		909	luc	455	Kentr	rub		
133	mic	310	Calth	pal	480	Cheli	maj	694	lan	911	mol	1082	Kickx	ela		
134	Apium	gra	311	Calys	sep	481	Cheno	*alb	695	mon	914	pra	1083	spu		
135	inu	312	sol	484	obs	696	obs	916			pus	1084	Knaut	arv		
137	nod	313	syl	487	fic	697	pal	917			pyr	1087	Koele	gra		
142	Arabi	tha	315	Campa	glo	493	pol	698	par	918	rob					
146	Arabi	hir	321	rap	502	Chrys	leu	700	ros	919	rot	1094	Lactu	ser		
151	Arciti	lap	320	rapunculo	503	par	705	Epipa	hel	920	san	1095	vir			
152	min	322	rot	504	seg	708		pal	923	Geum	int	1098	Lamia	alb		
153	yal	323	tra	506	Chrys	opp	710	ses	924		riv	1099	amp			
161	Arena	*ser	325	Caspe	bur	509	Cicho	int	712	Equis	arv	925	urb	1100	hyb	
162	ser	327	Carda	ama	513	Circa	lut	713	flu	929	Glauc	fla	1103	pur		
163	*ser	328	fle	514	Cirsi	acu	717	pal	930	Glaux	mar	1104	Lapsa	com		
166	Armer	mar	329	hir	515		721	tel	931	Glech	bed	1107	Lathr	squ		
167	Armer	rus	331	pra	516		726	Erica	cin	932	Glyce	dec	1108	Lathy	aph	
169	Arthro	*ser	333	Carda	dra	517	eri	731	tet	933		flu	1112	mon		
170	Artem	abs	335	Cardu	cri	520	pal	733	Erige	acr	934	max	1114	nis		
172	mar	337	nut	522	vul	735		can	935	ped	1115	pal				
175	vul	341	Carex	acu	523	Gladi	mar	740	Eriop	ang	936	pli	1116	pra		
176	Arum	mac	340	acuta	525	Clayt	per	745	Erodi	*cic	940	Gnaph	syl	1117		
182	Asper	cyn	342	app	528	Clema	vit	753	Erophi	*ver	941	uli	1125	Lemna	gib	
183	odo	344	are	530	Clino	vul	759	Erysi	che				1126	min		
185	Asple	adi	350	bin	532	Cochl	ang	762	Euony	eur			1127	pol		
182	rnt	355	car	533	dan	763	Euony	con	948	Gymna	con	1128	tri			
194	tri	357	con	535	off	764	Eupho	amy	949	Malim	por	1129	Leont	aut		
204	Aster	tri	359	cur	537	Coelo	vir	769	*cys	952	Heder	hel	1130	his		

As the Scheme proceeds, it is hoped that the Society's field meetings may be increasingly planned and used to produce lists of species from under-worked areas. Some experience, it is hoped, will be gained this season in a 'pilot scheme' which will enable such planning to be made for 1955.

Special arrangements are being made individually with vice-county recorders and compilers of County and Local Floras to avoid duplication of the work of collecting and assembling the data. In certain counties (e.g. Warwickshire) where a scheme is already in operation for the collection of data on a 1 kilometre Grid Square basis, such arrangements are particularly easy to make and could be mutually advantageous. Regional arrangements are also in hand for Wales (with the co-operation of the National Museum of Wales), and, also for Scotland. For Ireland, the Committee has accepted gratefully an offer of co-operation from Professor D. A. Webb of Trinity College, Dublin, whereby a separate Regional Office for Irish records is being set up; this will collect Irish data for incorporation and mapping in the head office in Cambridge.

At present, the main work of the Maps Office in Cambridge is concentrated on the planning and production of the cards for the filing system and for recording, and the correspondence with individuals offering to supply data. The quite considerable press publicity attendant on the launching of the Scheme has naturally produced a good many offers of help, each of which necessitates an individual reply, at least in some stage in the correspondence. In addition to *The Times* leader, articles or notes on the Scheme have appeared in *The Scotsman*, *News Chronicle*, *Country Life*, *Amateur Gardening* and *Gardening Illustrated*, and, more recently, in *Nature* (Vol. 173, p. 1079) and the *Irish Naturalists' Journal* (Vol. 11, pp. 201-203). An account has been published in the *School Science Review*, and an outline of the Scheme will appear in the *Journal of Ecology*.

Delivery and installation of some at least of the punched-card machinery is planned for September, when the incorporation of collected data can begin. It is hoped that the complete machinery will be installed by April 1955, so that some 'interim map' production can be undertaken to show areas obviously inadequately covered, to which field meetings and special recording parties may be directed.

It is the intention of the Committee that all native and naturalised species of vascular plant should be mapped (including, as far as is practicable, apomictic microspecies); but detailed decisions on final mapping must be postponed, both with regard to the inclusion or exclusion of particular species, and the desirability of producing more than one map of a species (i.e., of pre- and post-1900 records) to show a change of range.

Recorders are, however, encouraged to submit data about *all* wild species, including casuals and garden-escapes, because of the long-term value of the data as part of the Nature Conservancy's permanent record system. Detailed guidance as to the treatment of planted species and garden-escapes is being prepared, and will be available for all recorders.

DIFFICULTIES INHERENT IN THE SCHEME

(a) *Duplication of records*

A rough estimate of the total number of individual records needed for approximate completion of the Scheme is 2,500,000. Some duplication (either of the same locality, or of a locality within the same 10 kilometre square) is inevitable; but a great deal can be avoided by attempting to assign particular 10 kilometre squares to particular observers, and directing attention to unworked areas. In this way 'list' duplication of common species records can be kept to a minimum.

(b) *Indication of frequency*

The basic scheme is merely to indicate presence or absence per 10 kilometre square. It is not practicable to include an objective estimate of frequency on the punched card. It would, however, probably be practicable to indicate, by some appropriate symbol, dots *known* to be based on a single (or very few) records (e.g., in Cambridgeshire the records for *Melandrium dioicum* for grid squares 52/54, 52/65, 52/55, 52/35); in this way the final map would be much more informative.

(c) *Accuracy of records*

This is a considerable problem for which no single solution exists. Absolute accuracy is impossible; even the voucher specimen in a herbarium can be labelled in error with an incorrect locality. Several safeguards are, however, being adopted. Wherever possible, lists are to be submitted to the County Recorders for comment; voucher specimens will be required for any questioned records. Records backed by herbarium specimens will be so indicated on the punched cards; these can, therefore, if it is considered desirable, be indicated by a different symbol on the final maps. Further, when interim and final maps are produced, outlying records can be noted and checked individually.

(d) *Incomplete survey*

It is impossible to forecast how effectively the British Isles can be covered in five years. A good 'scatter' of records, even if far from complete, will, however, be an adequate basis for publication. Clearly there is no possibility of an absolute completion of the survey, if only because of constant floristic and vegetational change.

CONCLUSION

The project offers an opportunity, on a scale not previously known in botanical science in this country, of fruitful co-operation between amateur and professional in a field in which the amateur contribution has always been recognised as of first-rate importance. Its successful completion will provide scientists, (botanists, agriculturists, entomologists and many others) not only in this country but internationally, with a work of reference of major importance. The Botanical Society of the British Isles is a flourishing and expanding body; the Maps Scheme offers to its members at this time of active growth an opportunity of co-operative work which is unlikely to be paralleled for many years to come.