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:—
### 1a. Individual Record Card before Punching

<table>
<thead>
<tr>
<th>Species</th>
<th>Date</th>
<th>Altitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selenium carinifolia L.</td>
<td>5.26.47.69</td>
<td>3:0</td>
</tr>
<tr>
<td>Locality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chippendale Ten</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Habitat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rough pasture</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 1b. Same Record, Punched

<table>
<thead>
<tr>
<th>Species</th>
<th>Date</th>
<th>Altitude</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Rough pasture</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(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.
PALE 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.
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 cooperative work which is unlikely to be paralleled for many years to come.