

## Perceptions of change in English county Floras, 1660–1960

C. D. PRESTON

*CEH Monks Wood, Abbots Ripton, Huntingdon, Cambs. PE28 2LS*

### ABSTRACT

References to floristic change in county Floras have not hitherto received much attention, but they are a potential source of evidence for the extent of such change in the historical period. To explore this potential, references to change in the introductory sections of 68 English county Floras published between 1660 and 1960 are summarised and discussed. References to change are rare before 1860; after this date they are more frequent but few Floras published in any period have floristic change as a major theme. Notable exceptions are the Floras of Cambridgeshire (Babington 1860), Worcestershire (Lees 1867) and Middlesex (Trimen & Dyer 1869), all of which describe major changes in their areas. After 1890 many Floras included a list of extinct species. Several highlight change in coastal habitats, and some contain details of particular developments such as grassland improvement in Leicestershire and the effect of agricultural changes during the Second World War in a Gloucestershire parish. Most discussions of floristic change are based on subjective judgements, and the most vivid accounts are of changes experienced by the author. Few authors have made any detailed use of historical records, and it can be difficult to tell whether the absence of references to change indicates a relatively stable countryside or merely reflects an author's lack of interest in the subject. Quantitative measures of floristic change need to be developed and related to evidence of agricultural and other land-use history.

KEYWORDS: agricultural improvement, drainage, enclosure, extinction, floristic change, urbanisation, war.

### INTRODUCTION

Several recent studies have used the data contained in local and county Floras to assess the nature and extent of historic floristic change. Some authors, notably McCollin *et al.* (2000), have assessed floristic change by a direct comparison of two Floras, and others have combined the records contained in Floras with those from other sources to examine such change (e.g. Dony 1977; James 1997; Greenwood 1999, 2003; Preston 2000). The potential use of county Floras to modern botanists interested in assessing change is explored in detail by Walker (2003b).

The degree to which the authors of county Floras themselves reported, and commented upon, floristic change has received less attention. In this paper I have attempted an initial exploration of this subject, in the hope that it might not only be of intrinsic historical interest but might also provide some evidence of the extent to which floristic change was occurring in the past. Contemporary field botanists tend to regard the period since 1950 as one of unprecedented change, and in particular consider that the changes in land-use brought about by modern agricultural methods have had a more damaging effect on our native flora than any other developments in recent centuries. Does an examination of the way in which Flora writers perceived floristic change in earlier times support this view, or is there always a tendency for people to regard the times in which they live as ones marked by dramatic change?

### METHODS OF ASSESSING PERCEPTIONS OF CHANGE IN FLORAS

#### SCOPE OF THE STUDY

This study is restricted to the first editions of English county Floras published between 1660 and 1960 (Table 1, Fig. 1). I have examined 68 Floras, from the first accepted county Flora, John Ray's Cambridge Catalogue (1660), to Grose's *Flora of Wiltshire* (1957), the last Flora to appear before publication of the *Atlas of the British flora* (Perring & Walters 1962). These include Floras

TABLE 1. PRESENCE OF FOUR 'CHANGE FEATURES' (DEFINED IN THE TEXT) IN ENGLISH COUNTY FLORAS, 1660–1960.

| Area                | V.C. No.   | Author(s)           | Date      | 1                       | 2                                                  | 3                           | 4                      |
|---------------------|------------|---------------------|-----------|-------------------------|----------------------------------------------------|-----------------------------|------------------------|
|                     |            |                     |           | Preface mentions change | Introductory material includes paragraph on change | Old/ extinct records marked | Extinct species listed |
| Cambs.              | 29         | Ray                 | 1660      | No                      | No                                                 | No                          | No                     |
| Notts.              | 56         | Deering             | 1738      | No                      | N/A                                                | No                          | No                     |
| Cambs.              | 29         | Relhan              | 1785      | No                      | No                                                 | No                          | No                     |
| Oxon                | 23         | Sibthorp            | 1794      | No                      | No                                                 | No                          | No                     |
| Beds.               | 30         | Abbot               | 1798      | No                      | No                                                 | No                          | No                     |
| Northumb. & Durham  | 66–68      | Winch <i>et al.</i> | 1805      | Yes                     | No                                                 | No                          | No                     |
| Notts.              | 56         | Ordoyno             | 1807      | Yes                     | No                                                 | No                          | No                     |
| Midlands            | 37,38 etc. | Purton              | 1817      | No                      | No                                                 | No                          | No                     |
| Devon               | 3,4        | Jones & Kingston    | 1829      | No                      | No                                                 | No                          | No                     |
| Northumb. & Durham  | 66–68      | Winch               | 1831      | N/A                     | No                                                 | No                          | No                     |
| Oxon                | 23         | Walker              | 1833      | No                      | No                                                 | No                          | No                     |
| W. Devon & Cornwall | 1–4        | Jacob               | 1836      | N/A                     | N/A                                                | No                          | N/A                    |
| Notts.              | 56         | Howitt              | 1839      | N/A                     | No                                                 | No                          | No                     |
| Yorks.              | 61–65      | Baines              | 1840      | No                      | No                                                 | No                          | No                     |
| Salop               | 40         | Leighton            | 1841      | No                      | No                                                 | No                          | No                     |
| Herts.              | 20         | Webb & Coleman      | 1849      | No                      | No                                                 | No                          | No                     |
| Leics.              | 55         | Kirby               | 1850      | Yes                     | No                                                 | No                          | No                     |
| Wight               | 10         | Bromfield           | 1856      | Yes                     | Yes                                                | No                          | No                     |
| Cambs.              | 29         | Babington           | 1860      | No                      | Yes                                                | Yes                         | Yes                    |
| Suffolk             | 25–26      | Henslow & Skepper   | 1860      | No                      | No                                                 | No                          | No                     |
| Essex               | 18–19      | Gibson              | 1862      | Yes                     | Yes                                                | Yes                         | Yes                    |
| W. Yorks.           | 63–64      | Miall & Carrington  | 1862      | No                      | No                                                 | No                          | No                     |
| N. Yorks.           | 63–64      | Baker               | 1863      | No                      | No                                                 | No                          | No                     |
| Surrey              | 17         | Brewer              | 1863      | No                      | No                                                 | No                          | No                     |
| Devon & Cornwall    | 1–4        | Keys                | 1866–1872 | No                      | No                                                 | No                          | No                     |
| Norfolk             | 27–28      | Trimmer             | 1866      | No                      | Yes                                                | No                          | No                     |
| Worcs.              | 37         | Lees                | 1867      | No                      | Yes                                                | Yes                         | Yes                    |
| Northumb. & Durham  | 66–68      | Baker & Tate        | 1868      | N/A                     | No                                                 | Yes                         | No                     |
| Middlesex           | 21         | Trimen & Dyer       | 1869      | No                      | Yes                                                | Yes                         | Yes                    |
| Dorset              | 9          | Mansel-Pleydell     | 1874      | No                      | Yes                                                | Yes                         | No                     |
| London              | 21         | De Crespigny        | 1877      | Yes                     | No                                                 | Yes                         | No                     |
| Hants. & Wight      | 10–12      | Townsend            | 1883      | No                      | Yes                                                | No                          | No                     |
| Lake District       | 69–70      | Baker               | 1885      | No                      | No                                                 | No                          | No                     |
| Oxon                | 23         | Druce               | 1886      | No                      | No                                                 | No                          | Yes                    |
| Leics.              | 55         | Mott <i>et al.</i>  | 1886      | Yes                     | No                                                 | Yes                         | Yes                    |
| Sussex              | 13–14      | Arnold              | 1887      | No                      | No                                                 | No                          | No                     |
| Herts.              | 20         | Pryor               | 1887      | No                      | Yes                                                | No                          | No                     |
| W. Yorks.           | 63–64      | Lees                | 1888      | No                      | No                                                 | Yes                         | No                     |
| Wilts.              | 7–8        | Preston             | 1888      | No                      | No                                                 | No                          | No                     |
| Herefs.             | 36         | Purchas & Ley       | 1889      | No                      | No                                                 | No                          | No                     |
| Suffolk             | 25–26      | Hind                | 1889      | No                      | No                                                 | No                          | No                     |
| Derbys.             | 57         | Painter             | 1889      | No                      | No                                                 | No                          | No                     |
| Warks.              | 38         | Bagnall             | 1891      | No                      | No                                                 | No                          | No                     |
| Somerset            | 5–6        | Murray              | 1896      | No                      | No                                                 | No                          | Yes                    |
| Berks.              | 22         | Druce               | 1897      | No                      | No                                                 | No                          | Yes                    |
| Cumberland          | 70         | Hodgson             | 1898      | N/A                     | No                                                 | No                          | No                     |
| Cheshire            | 58         | De Tabley           | 1899      | No                      | Yes                                                | No                          | No                     |
| Kent                | 15–16      | Hanbury & Marshall  | 1899      | No                      | No                                                 | No                          | Yes                    |

TABLE 1. CONTINUED

| Vice-county | V.C. No. | Author(s)                 | Date      | 1                       | 2                                                  | 3                           | 4                      |
|-------------|----------|---------------------------|-----------|-------------------------|----------------------------------------------------|-----------------------------|------------------------|
|             |          |                           |           | Preface mentions change | Introductory material includes paragraph on change | Old/ extinct records marked | Extinct species listed |
| Staffs.     | 39       | Bagnall                   | 1901      | N/A                     | No                                                 | No                          | No                     |
| E. Yorks.   | 61       | Robinson                  | 1902      | No                      | No                                                 | No                          | Yes                    |
| Derbys.     | 57       | Linton                    | 1903      | No                      | No                                                 | No                          | Yes                    |
| W. Lancs.   | 60       | Wheldon & Wilson          | 1907      | No                      | Yes                                                | No                          | Yes                    |
| Worcs.      | 37       | Amphlett & Rea            | 1909      | No                      | No                                                 | No                          | No                     |
| Cornwall    | 1-2      | Davey                     | 1909      | No                      | No                                                 | Yes                         | Yes                    |
| Norfolk     | 27-28    | Nicholson                 | 1914      | N/A                     | No                                                 | No                          | No                     |
| Bucks.      | 24       | Druce                     | 1926      | No                      | Yes                                                | No                          | Yes                    |
| Northants.  | 32       | Druce                     | 1930      | No                      | Yes                                                | No                          | Yes                    |
| Surrey      | 17       | Salmon                    | 1931      | Yes                     | No                                                 | Yes                         | No                     |
| Leics.      | 55       | Horwood & Noel            | 1933      | No                      | Yes                                                | No                          | No                     |
| Sussex      | 13-14    | Wolley-Dod                | 1937      | N/A                     | Yes                                                | No                          | Yes                    |
| Westmorland | 69       | Wilson                    | 1938      | No                      | Yes                                                | No                          | Yes                    |
| Cambs.      | 29       | Evans                     | 1939      | No                      | Yes                                                | Yes                         | Yes                    |
| Devon       | 3-4      | Keble Martin & Fraser     | 1939      | No                      | No                                                 | No                          | Yes                    |
| Dorset      | 9        | Good                      | 1948      | No                      | No                                                 | No                          | Yes                    |
| Gloucs.     | 33-34    | Riddelsdell <i>et al.</i> | 1948      | No                      | Yes                                                | Yes                         | Yes                    |
| London      | 21       | Kent & Lousley            | 1951-1957 | Yes                     | No                                                 | No                          | No                     |
| Beds.       | 30       | Dony                      | 1953      | No                      | No                                                 | No                          | Yes                    |
| Wilts.      | 7-8      | Grose                     | 1957      | No                      | No                                                 | No                          | No                     |

N/A denotes not applicable (e.g., if the Flora lacks a Preface, N/A is entered under 1). Full details of the Floras are cited in the bibliography.

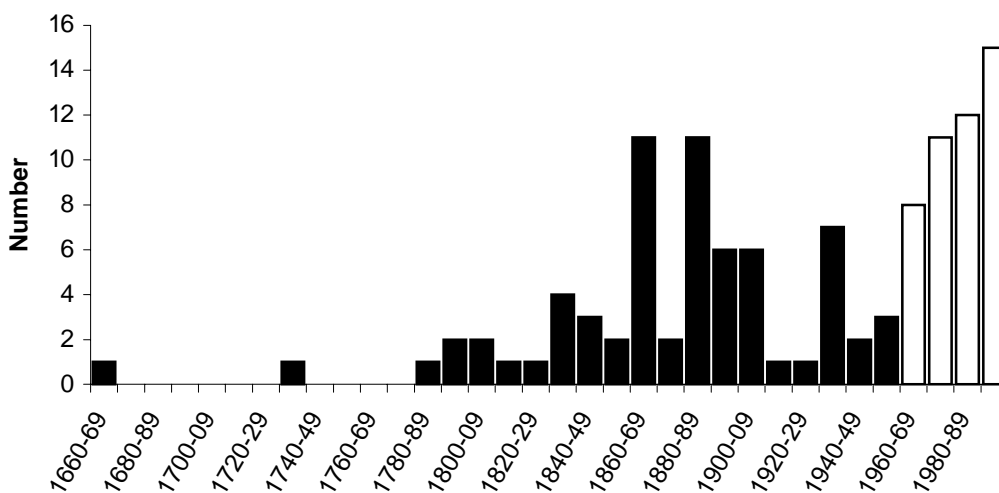


FIGURE 1. The number of county floras published per decade between 1660 and 1999. The diagram distinguishes those Floras published between 1660 and 1959, the subject of this paper.

of the Lake District and the London region, areas which are as large as some traditional counties. After 1962 there was a great revival of the county Flora tradition and this date can therefore be taken as marking the transition from the historical to the modern era of Flora-writing. I have restricted the coverage to England, as adding the other countries of the British Isles increases the heterogeneity of the study area without a proportional increase in the number of Floras. I have excluded check-lists, which are insufficiently detailed to be of any use in this context. More reluctantly, I have excluded 'local Floras', those covering smaller areas than vice-counties, simply to limit the size of the task. Finally, I have (with a few stated exceptions) only considered changes from the 16th century onwards to plants which are classified by Preston *et al.* (2002) as native species or archaeophytes. Archaeophytes are ancient introductions, defined as plants which are believed to have become established in the wild before AD 1500.

#### COMPARISON OF FLORAS

County Floras are remarkably varied. The *Flora of Essex* by S. T. Jermyn (1974, p. 3) excluded old (pre-1930) records on the grounds that "their inclusion only artificially inflates the number of county records; also, apart from following the slavish conventions of writing a county Flora, such records merely stimulate an idle curiosity for many, with a very limited interest for a few. I cannot see what is to be gained, either scientifically or historically, to include *Otanthus maritimus* which has not been refound in Essex since it was recorded from Mersea Island, by Gerard, in 1597....". In contrast, *The historical Flora of Middlesex*, published in the very next year (Kent 1975), lovingly details the county's historical records from 1548 onwards. Floras published in the three centuries from 1660 are even more varied in both format and content. As a consequence, the comparison of Floras, like the comparison of any dissimilar objects, is fraught with difficulties.

To compile a list of all references to change in all 68 Floras would be a mammoth task. After initial examination of some Floras, I recorded the following 'change features' for each one:

1. *Is change in the native flora mentioned in Preface, e.g. as one of the reasons given for producing the Flora?*

The reasons for writing a county Flora are often outlined in the Preface. These frequently include the accumulation of records since the last Flora of the county, but I have not treated this as a reference to floristic change.

2. *Is there at least one paragraph in the introductory or concluding material (outside the Preface and the species accounts) devoted to floristic change affecting native species in the historic period (1500 onwards)?*

The restriction of this criterion to the historic period excludes those Floras which discuss (in general terms) disafforestation and other land-use change since the Norman Conquest, for example.

3. *Are old records, or sites where the species is extinct, clearly and obviously distinguished from new records in the species accounts?*

This requires an explicit marking of old or extinct records. Many Floras list records chronologically or provide the readers with some evidence which enable them to date a record at least approximately (e.g. recorder's name, literature reference) but such Floras do not qualify under this criterion. The difference between old and current records must be immediately apparent. I have not counted under this criterion those Floras which indicate taxa which are extinct (the annotation must apply to individual records) nor have I included Floras which mark records as 'extinct or dubious'.

4. *Is there a list of extinct species?*

This also refers to extinctions in the historic period.

These four 'change features' do not provide a comprehensive picture of the references to change in each Flora: there are often, for example, brief references (less than a complete paragraph in length) in the introductory material and additional references in the individual species accounts. Nevertheless, the 'change features' do provide a broad indication of the extent to which the authors of particular Floras were concerned with floristic change.

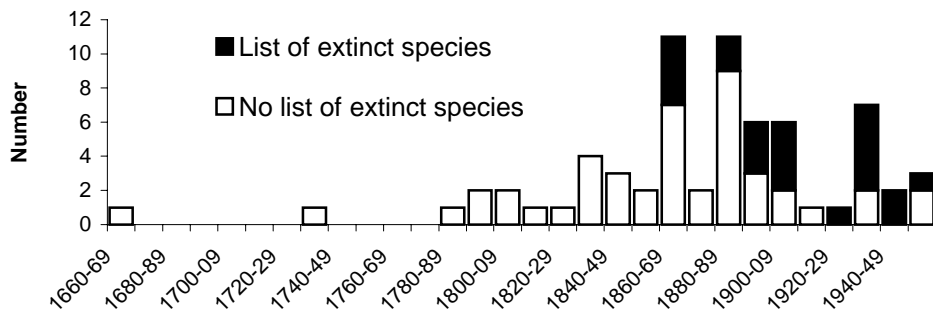


FIGURE 2. The number of county Floras published in each decade between 1660 and 1959 which contain (or do not contain) a list of extinct species.

#### REFERENCES TO CHANGE IN COUNTY FLORAS, 1660-1960

The occurrence of the four 'change features' listed above in Floras published between 1660 and 1960 is documented in Table 1. Very few Floras published before 1860 include any of the four features. Lists of extinct species appear in Floras from the 1860s onwards, and they are present in most 20th century Floras (Fig. 2). The other three change features occur sporadically in Floras from the 1860s, but these show little evidence for an increase in frequency with time. Only one of the five Floras published in the 1940s and 1950s, for example, devotes a paragraph in the introductory material to floristic change. The overall impression is that change is not an important consideration for many Flora writers in this period. Nevertheless, a general tendency for considerations of change to become more frequent from the 1860s is apparent from Fig. 3, which shows the proportion of Floras with at least one change feature in the decades since 1660.

As the Floras are so varied in their approach, it is more useful to discuss them individually than to generalise. I have divided them into chronological groups and, within the period when most Floras were written, 1860–1914, selected some areas where the contrast between different Floras is particularly informative.

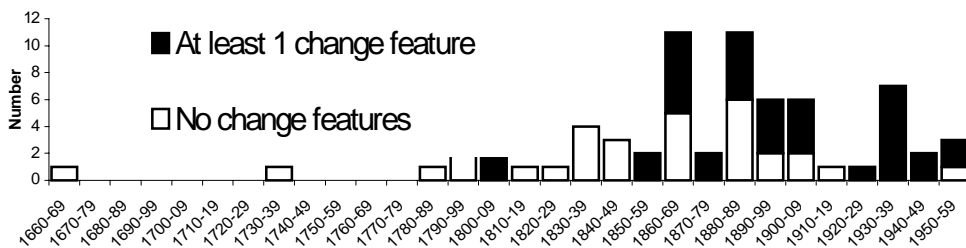


FIGURE 3. The number of county Floras published in each decade between 1660 and 1959 which contain (or do not contain) at least one of the four 'change features' defined in this paper.

#### THE PIONEER FLORAS, 1660-1859

There are very few 'change features' in the early Floras. The first example is found in the Preface to *The botanist's guide through the counties of Northumberland and Durham* (Winch *et al.* 1805), in which the authors explain the format of their Flora:

"As botanists however have been frequently misled by the insertion of plants in provincial Floras, which, by cultivation or some other cause, had been extirpated a long time previous to their habitats having been published, and the value of the following pages chiefly depending upon their accuracy in this particular, the Editors have thought it proper on that account, to state the authorities on which the catalogue rests".

This is at first sight a most surprising statement. Which Floras had misled botanists by including localities where plants were already extinct? Very few county Floras had been published before 1805, and although there were certainly other publications which might count as “provincial Floras”, there were not very many (Henrey 1975). I have wondered whether the authors were thinking of Cambridgeshire. Floras of Cambridgeshire had been published by Ray (1660) and Relhan (1785, with a second edition in 1802), and other floristic works published before 1805 include those of Martyn (1727) and Martyn (1763). Babington (1860, p. x) could not tell whether many of the records in Relhan (1785, 1802, 1820) were repetitions of previously published records or whether Relhan had himself confirmed the occurrence of a species at a site, and the situation is no clearer to the modern reader. However, all the authors of *The botanist's guide ...* appear to have been firmly rooted in the Newcastle area, with no connections that I can detect to Cambridge. If they were referring to Cambridgeshire, they must presumably have heard about the problem from others.

A similar indication that floristic change was occurring in northern England in the early 19th century comes from grandiloquent prose in the Preface to Ordoyno's (1807) *Flora Nottinghamiensis*:

“nearly a century has elapsed, since Deering published his ‘Catalogue of plants naturally growing about Nottingham;’ and although the busy hand of human industry has, in the lapse of time, altered the face of nature, and expelled many of these inoffensive tribes from the habitations, which they formerly occupied, still they are not extirpated; they are, even at this day, to be discovered, by their diligent votaries, in those sheltered assylums, where cultivation has not invaded the privacy of their sequestered retreat.”

Baines (1840, p. xii) refers briefly to the agricultural improvement of the “dark and wearisome moorlands” of N. E. Yorkshire. “It is gratifying to believe that some part of this poor country is under a course of gradual improvements by the beneficial operation of the Pickering and Whitby Railway, which from either end brings lime, the grand improver of moorland, at moderate cost.”

In contrast to these references to change, Mary Kirby's comments in *A Flora of Leicestershire* (1850, p. v) on Pulteney's earlier lists of the plants of the county (1757, 1795) are indicative of stability:

“Antiquated as these catalogues may appear, the experience of each succeeding summer has tended to confirm their accuracy. *Aquilegia vulgaris*, and the two or three plants that may probably be extinct, are the exceptions, and not the rule.”

The last Flora of the pioneer period, Bromfield's *Flora Vectensis* (1856, pp. xvi–xvii), gives a very different picture of change on the Isle of Wight. Justifying the inclusion of the dates of discovery of the rarer or more local species, which he feared might be thought to lack “practical use or interest to the collector”, he argued:

“when it is considered how rapid are the changes which the surface of this island is yearly, monthly and daily undergoing, from the progress of building and its invariable attendant, increased cultivation; – low lands, but lately waste, now inclosed, and spots not long since free, and accessible to every wanderer in search of health or recreation, at this time dotted with tenements, their sites fenced from the intrusion of stranger footsteps with the jealous exclusiveness of individual appropriation; – it will be evident that the *first* recorded station for some rare or local plant may often be the *last* on record ...”

These comments have an urgency missing from the earlier references to change. They read as if they are based on personal experience, suggesting that Bromfield, as he is writing, has in his mind's eye a favourite place from which he is now excluded and where he fears that some species may face extirpation. By contrast, Ordoyno's observations on the “busy hand of human industry” seem theoretical and generalised. This may just be a reflection of their different prose styles, but Bromfield's remarks herald a concern about change that was to become evident in some of the Floras of the 1860–1914 period.

FLORAS OF THE EASTERN COUNTIES, 1860–1914

#### *Cambridgeshire*

Babington's *Flora of Cambridgeshire* (1860) dealt with floristic change to a much greater extent than any previous Flora, and the design of the book reflects this. One of Babington's aims was “to record not merely the present state of our Flora but also its condition before the great alterations

caused by modern enclosures and drainage: alterations still advancing so rapidly that probably many of the places in which I have myself gathered plants within the last few years do not now produce them. The localities given by the older Botanists, but which have not been confirmed by recent observers, are inserted on their authority and markedly separated from the rest by being printed in Italics, so as to point out their historical not modern character” (pp. xi–xii). The changes which had taken place since 1800 in the different areas of the county are discussed in the introduction, and for the first time in a county Flora there is a list of “lost plants”.

Babington’s comments (1860, pp. xiv–xxiii) on the changes which had taken place in the county are well known. The Chalk Country which “until recently (within 60 years)” was “open and covered with a beautiful coating of turf, profusely decorated with *Anemone Pulsatilla*, *Astragalus Hypoglottis* [*A. danicus*], and other interesting plants ... is now converted to arable land, and its peculiar plants mostly confined to small waste spots by road-sides, pits, and the very few banks which are too steep for the plough. Thus many species which were formerly abundant have become rare” and “even the tumuli, entrenchments, and other interesting works of the ancient inhabitants have seldom escaped the rapacity of the modern agriculturist, who too frequently looks upon the native plants of the country as weeds, and its antiquities as deformities”. The plants of the Clayey District “have suffered nearly as much ... where they were once abundant they are now rarely to be found”. The Fens “have undergone an equally if not more destructive change than the Chalk district” as steam drainage had rendered the whole level “a pattern in farming”. “With the water many of the most interesting and characteristic plants have disappeared, or are become so exceedingly rare that the discovery of single individuals of them is a subject for wonder and congratulation. There is scarcely a spot remaining (I only know of one, near Wicken) in which the ancient vegetation continues undisturbed and the land is sufficiently wet to allow of its coming to perfection. Owing to the necessary existence of numerous ditches ... those plants which are absolutely aquatic have not suffered so greatly as the others; but they are fast decreasing, now that the steam-engine causes even many of the ditches to be dry in summer”.

The marked changes discussed by Babington were the result of an extensive reorganisation of the agriculture of the county in the early 19th century. Two waves of parliamentary enclosure, followed by widespread agricultural improvement, had resulted in habitat destruction on a massive scale – the ploughing of chalk grassland and heathland, the drainage of wetlands in the south of the county and the use of steam drainage in the fens (Preston 2000). Babington was able to document these changes because of the long sequence of historical records available to him (Table 2). Thus Babington’s Flora resulted from an unprecedented combination of circumstances – a long sequence of historical records followed by a period of very rapid floristic change.

TABLE 2. SOURCE’S OF BABINGTON’S (1860) RECORDS CITED “SOLELY UPON THE AUTHORITY OF THE OLDER BOTANISTS”.

| Source                       | Date of source                          | Percentage of older records from this source |
|------------------------------|-----------------------------------------|----------------------------------------------|
| J. Ray and contemporaries    | 1660–1685                               | 18                                           |
| J. Martyn                    | Active c. 1727–1735                     | 18                                           |
| T. Martyn                    | Least inactive 1762–1785                | 2                                            |
| J. Lyons                     | 1763                                    | 2                                            |
| J. Fisher                    | c. 1770                                 | 3                                            |
| R. Relhan and contemporaries | 1785–1820                               | 54                                           |
| Others                       | Mostly late 18th and early 19th century | 3                                            |

Dates indicate the period when the records were originally published, or when the botanist was active. For the dating of the botanical activity of J. & T. Martyn, see Walters (1981).

*Other eastern counties*

The historical record available to Kirby Trimmer for his *Flora of Norfolk* (1866) was less extensive than that which Babington had drawn upon for Cambridgeshire. Nevertheless, Trimmer thought that change was occurring at a similar rate in West Norfolk. In the early part of the reign of George III (1760 onwards) West Norfolk “consisted chiefly of dry heath lands, open sheep walks, and sandy warrens, wet marshes, bogs, and fens; but within the last half century the first three of these have been greatly reduced in number and extent by enclosure, and the greater portion of the other descriptions of soil, after drainage, subjected to the plough, or converted into meadows.” By contrast, East Norfolk had by 1760 “long been enclosed” (pp. xiv–xv). One feature which Trimmer regarded as particularly characteristic of Norfolk was the system of ‘Land Dressing’, or importing soil from other districts to temper the local soils so “wet soils are rendered dry, and dry soils sufficiently moist, adhesive soil loose, and loose soils sufficiently adhesive”. As a result, “plants which naturally prefer the sand, the chalk, and clay, are often found in proximity ...” (pp. xvi–xvii).

Authors of other Floras of the eastern counties presented a picture of much less dramatic change. Gibson’s (1862) *Flora of Essex* was inspired by Babington’s *Cambridgeshire* and is modelled upon it. Although Gibson recognised that “Essex is in some degree a new botanical field, since no separate Flora or list of its plants has as yet appeared”, the older herbals and British Floras contained many Essex records and these provided “data on which we may endeavour to estimate how far our present Flora has been changed by the progress of cultivation, and by other causes” (pp. vi–vii). He concluded that “a certain amount of change seems to have been produced by the progress of cultivation, drainage, and enclosure, and by the felling of woods, though the effects are less evident than in Cambridgeshire. The plants supposed to have become extinct are not numerous; less than a dozen species altogether ... Several others are, however, fast becoming scarce ...” (pp. xvii).

Pryor’s (1887, p. xxxvii–xxxviii) *Flora of Hertfordshire* also concluded that “the botany of the county within the historic period has undergone less change than that of Cambridgeshire from its fen-reclamation, or Middlesex from the encroachment of building”. Admittedly, he uses this argument rather self-servingly to justify the absence from his Flora of the sort of detailed treatment of the lives of the older botanists provided by Trimen & Dyer (1869). Hind, in his *Flora of Suffolk* (1889, p. xxxiv), also commented that “a gradual change is taking place in the Flora of the County. Several plants of the early part of this century are now no longer to be found, and others are becoming rarer every day. To meet this, there is a constant succession of foreign plants becoming naturalised ... The change, however, is so slow, that there is no reason to fear that the distribution of plants in Britain will be greatly modified in the course of succeeding centuries”.

Trimen & Dyer’s *Flora of Middlesex* (1869) is a special case, as the London metropolis has come to dominate that county. Trimen & Dyer include a detailed discussion of the nature and extent of the changes brought about by the growth of London. In particular, they stress the destruction of heathland (especially the enclosure and cultivation of thousands of acres in the early 19th century), the grubbing up of the few remaining woodlands, the extraction of brick earth in numerous brickyards, the construction of canals and the New River set against the conversion of numerous streams to subterranean sewers, and the remorseless advance of the built-up area of London. Those localities where species are “certainly or very probably extinct” are marked, and a list of “probably extinct” species in the county as a whole is included in the Flora.

De Crespigny (1877) cited changes in the flora of the London area since the publication of Cooper’s *Flora Metropolitana* (1836) as one of the main reasons why *A New London Flora* was required. “It is a well-known fact that vegetation everywhere alters to a certain extent with the lapse of time; it does so to a marked degree in the neighbourhood of London, where the disturbing elements of clearing, draining, building, enclosing, are perpetually at work”.

In summary, writers of Floras of the eastern counties were prompted by Babington’s *Flora of Cambridgeshire* to consider floristic change. Their comments suggest that there was considerable variation in the rate of change from county to county.

FLORAS OF THE WEST MIDLANDS, 1860–1914

*Lees’ account of ‘The botany of Worcestershire’*

Edwin Lees was singled out by John Gilmour as the Victorian author who, in his book *The*



*botanical looker-out*, plumbed the lowest depths of “ludicrous and pretentious sentimentality” (Gilmour & Walters 1954, p. 23). Nevertheless, Lees’ *The botany of Worcestershire* (1867) provides an account of floristic change which is, in its way, even more remarkable than that in Babington’s *Flora of Cambridgeshire*. *The botany of Worcestershire* is not without its defects, and it only just qualifies as a county Flora. Over 200 pages of repetitive and disorganised introduction precede the 36 pages devoted to the systematic catalogue. Lees confesses that he has covered not only Worcestershire but also Herefordshire and Warwickshire, it being “a relief not to be too closely confined to a comital boundary” (p. vi). Indeed, he “felt inclined to take in or enclose for botanical purposes, portions of the adjacent counties which really *geographically* belong to us” (p. 2), an attitude similar to that later taken by J. W. Heslop Harrison (Pearman & Preston 2000, pp. 11–12). This cavalier approach to the admittedly complex county boundary, and Lees’ botanical inconsistencies and inaccuracies, have left a corpus of ambiguous records to exasperate authors of later Floras. Yet, despite these faults, Lees produces a vivid picture of floristic change in his area, based on some earlier records and his forty years of personal observation. This reflects his strong personal interest in the subject. Even the book of poems he published in his old age (Lees 1880) begins with four on the theme ‘Landscape changes and rural transformations’.

Lees noted the mosses and fungi which colonised areas where charcoal was burnt in the Wyre Forest (p. lxxii) and the plants growing in places from which turf had been pared away at Rednall (p. 116), as well as the positive responses of *Campanula patula*, *Cephalanthera longifolia*, *Epipactis purpurata* and *Festuca altissima* to coppicing (pp. 18–20). However, most of his observations deal with change on a rather longer timescale. The effects of drainage are repeatedly referred to. “Before Moseley Wake Green was enclosed (which I remember in its integrity) and the bogs drained, this must have been a locality of surpassing interest, and even now, though the bogs are almost extinct, yet as several pools yet remain, a stroll along their margins may still discover the last relics of a banished race ... botanists must solace themselves, as Mr. Mathews says, ‘with the reflection that their place will be supplied by much more important and profitable vegetation’” (pp. 119–120). At Feckenham Bog, eight miles from Droitwich “in the early part of the present century ... dreary moors extended for some distance around. The cottagers of the vicinity dug the turf of the bog for fuel as is still done in Wales ... coal was a luxury unknown ... The site even of the bog is now found with difficulty, cultivated meadows and arable land alone presents itself to the view, and all the above mentioned plants [which included *Anagallis tenella*, *Baldellia ranunculoides*, *Cirsium dissectum*, *Cladium mariscus*, *Pinguicula vulgaris* and *Schoenus nigricans*] have disappeared from the locality” (p. 96). A rather different site, Longdon Marsh, “a waste of about 3,000 acres” was “a large lake in rainy seasons ... but a commission is at present engaged in the somewhat expensive project of draining it, with what results remains to be seen” (p. lxvi).

The enclosure of heathland, as in the eastern counties, is another marked change. Whinwood Heath, for example, “was a few years since a waste ... as rough and wild as any common left to Nature’s keeping; but its scattered birch trees have been cut down, it has been enclosed, and if more valuable to the farmer, it has ceased to possess any interest to the botanist” (p. 126). Near Bromsgrove in “the heathy part of Worcestershire”, “the bogs are mostly drained, and the hills cultivated, except on their very tops, or where the Windsor family owners of the soil have enclosed it, and planted firs and larches for the preservation of game” (p. 138). Although these conifer plantations contained interesting fungi, the “diligent Cryptogamous botanist” was warned that this area “requires to be furtively trodden” (p. 118).

In addition to the enclosure of common land, “recently too, hedges have been extensively stubbed up, and coppices cut down” (p. xxxiii). *Juniperus communis* “from being remorselessly cut down, has become almost extinct in the county” (pp. 137–8), both this species and *Sorbus torminalis* “being of slow growth, when cut down are not renewed” (p. xxxii–xxxiii). In the county as a whole “very few old trees can be said to exist, though there are many that from premature decay put on the appearance of ‘dry and bald antiquitie’” (p. xxxvii).

Water course management and pollution also had an impact on the flora. At Badsey, the ditches were “so deep that nothing can grow on their sides” (p. 95). At Worcester, the River Severn “under the direction of the Severn Navigation Commissioners, has by weirs and locks been raised, so that the waters have an uniform depth of five or six feet, the *Ranunculus* no longer flowers, not being

able to reach the surface, though yet existing below the water in an unflowering state" (p. xxxvi). The Stour, "pure and bright in its childhood, becomes dirty as a begrimed medicant in its progress through Kidderminster" (p. 124).

The destructive effects of building are sometimes mentioned. Yardley "abutting upon smoky Birmingham, whose polypoid arms have spread into its once lonely fields and woods ... has been so invaded and built upon of late years, that ... I have heard of nothing of importance recently gathered there" (p. 121). Industrial pollution was also noticeable. At Cradley "there is no resisting manufactures and smoke, and Flora retreats disgusted from the vicinity of iron works, and the dismalities that surround a nail-making population ... there are no plants ... worthy of notice to record. Even the Lichens ... will not grow upon the trees at Cradley" (pp. 129–130). (This observation was published only eight years after Grindon (1859) first reported the effects on industrial pollution on lichens.)

The effects of change on individual plant populations are also considered. The single *Sorbus domestica* in the Wyre Forest, for example, famously suffered "wanton destruction by ruffian hands" (p. xci). A unusual lowland population of *Asplenium viride* on Ham Bridge was destroyed by "an unfortunate renovation of the structure" (p. 87) while the population of the introduced umbellifer *Anthriscus cerefolium* was eliminated when "those Vandals (as respects botanists), the Road Surveyors, last year altered the course of the Bristol road, cut the bank away ... and not even a stray plant is now to be met with there" (p. lxxxix).

Some of Lees' observations correspond with those being made by modern botanists. "A few scraggy native Black Poplars (*P. nigra*) appear in various localities by brook sides, but this tree appears to be dying out" (p. xl) as "old gnarled stubs ... are not uncommon, but no young trees of this species now appear ..." (p. xxxiii). Lees also notes that *Brachypodium pinnatum* "which, useless as a grass, yet on the sides of Bredon Hill, left wild, or only occasionally stocked, spreads greatly, forming rounded patches yards in diameter, wholly untouched by cattle, and thus seeds unchecked, besides spreading by short rhizomes, until much of a pasture is usurped by this coarse and distasteful species" (p. lii). He also commented on the spread of *Urtica dioica*: "in the once undesecrated 'Winding Valley' ... the track of the subterranean water-course is marked by a line of Nettles that seem to have sprung up in the footsteps of the workmen, and show where their polluting influence extended". Indeed, he considered that this species "is seen to follow the footsteps of man with such dogged pertinacity" that he thought it probable enough that it was an alien (pp. 139–140).

Some species benefited, at least temporarily, from the changes to the countryside. "The year after the ground was excavated for the Severn Valley Railway between Stourport and Bewdley, the mass of scarlet poppies (*Papaver rhoeas*) that lined the embankment was wonderful to behold ... Yet, though probably many of the poppies seeded, this extraordinary profusion has not been maintained" (pp. xii–xiii). A more permanent expansion of range was shown by *Chamerion angustifolium* which "quite recently ... has become numerous in several parts of the Vale of Severn, and promises to spread, incited to take possession of new made roads and embankments" (p. 24). Lees thought that "agricultural weeds are upon the increase, in spite of the treatises written to destroy them" (p. 140). One such was *Legousia hybrida*, which "is now very plentiful in the arable fields on Broadway ... yet it must be remarked that this species must have been introduced on Broadway Hill since its enclosure and cultivation" (p. 103). Other plants, including *Hyoscyamus niger* and *Onopordium acanthium*, were often found on "deposits of manure or rubbish from gardens on roadsides" although "these wandering plants ... all prove fugacious, and are seldom seen in the following season" (p. 21).

#### *Standard Floras of the West Midland counties*

The impression one gets from *The botany of Worcestershire* of an ever-changing flora is at variance with the accounts in the standard Floras of Herefordshire (Purchas & Ley 1889), Worcestershire (Amphlett & Rea 1909) and Warwickshire (Bagnall 1891). None of these Floras contain any of the 'change features' defined earlier in this paper. Even the species accounts in Purchas & Ley (1889) reveals remarkably few references to change. They do mention the increase in the county of *Medicago arabica* and *M. polymorpha*, species which had been introduced to some gardens with river gravel, the similar spread of *Bromopsis erecta* with limestone road-mending materials, the increase of *Chamerion angustifolium* and *Pastinaca sativa* on railway

embankments, and an interesting reference to the deliberate sowing of *Trifolium micranthum* on lawns. The species lost from the county are *Sparganium natans*, as its only known site, a small pool, was drained, and a puzzling *Epipactis*, whose site was converted to a deer park. Single sites were lost for *Anagallis tenella*, *Apium nodiflorum*, *Drosera rotundifolia*, *Orobanche rapumgenistae*, *Pinguicula vulgaris*, *Ranunculus circinatus*, *Sagina nodosa* and possibly *Phragmites australis*. The destruction of single trees of *Rhamnus cathartica* and *Salix alba* is noted. All in all, this seems remarkably little change considering that the authors' collective experience of the county extended back over 40 years.

An examination of the species accounts in Amphlett & Rea (1909) reveals rather more references to change in Worcestershire, especially in those parts of the county which border on the Birmingham conurbation. *Anagallis tenella*, *Baldellia ranunculoides*, *Drosera rotundifolia*, *Menyanthes trifoliata* and *Potentilla palustris* are identified as wetland species which are "steadily disappearing through the drainage of bogs and the advance of modern conditions" (p. 124) or "rapidly vanishing from the face of our county" (p. 149). *Juniperus communis* also "appears to be slowly vanishing". *Gymnocarpium dryopteris* "has to a great extent disappeared from the county, owing, it is to be feared, to the ravages of the fern-hunter" and both *Oreopteris limbosperma* and *Primula vulgaris* had suffered from collecting by gardeners or for sale in Birmingham. Although these and a few similar observations might be thought to indicate a changing Flora when they are gathered together, one has to read 441 closely printed pages to find them.

The absence of any general reference to change in Bagnall's (1891) *Flora of Warwickshire* is particularly surprising as Birmingham itself falls in this vice-county. By reading through the species accounts I have found some 15 species which were either thought to be extinct, possibly extinct or had not been refound recently (e.g. *Huperzia selago*, *Hypochaeris glabra*, *Mentha pulegium*, *Phyllitis scolopendrium*, *Vicia sylvatica*) or were in general decline (e.g. *Asplenium adiantum-nigrum*, *Calluna vulgaris*, *Menyanthes trifoliata*, *Narthecium ossifragum*, *Schoenoplectus tabernaemontani*). A further twenty species were declining or extinct at particular sites (e.g. *Botrychium lunaria*, *Ceratocarpus claviculata*, *Lactuca virosa*, *Nymphaea alba*, *Vaccinium vitis-idaea*). However, a more striking feature of the Flora is the number of old records which are cited without comment. These include many of William Withering's late 18th century records from the Birmingham area. The population of the Borough of Birmingham had doubled between 1760 and 1801 and then increased from 71,000 in 1801 to 401,000 in 1881. The suburbs outside the borough boundary also expanded greatly (Gill 1952; Sutcliffe & Smith 1974). In the course of this growth, all that remained of Birmingham Heath was enclosed and built on in 1799 (Gill 1952, p. 121). Nevertheless, Withering's records from this locality of species such as *Drosera rotundifolia*, *Eriophorum angustifolium*, *Hypericum elodes*, *Nardus stricta*, *Potamogeton polygonifolius*, *Rhynchospora alba* and *Utricularia vulgaris* are cited without any indication that they may have become extinct there. (Bagnall did refind *Calluna vulgaris* in this area, so some acidic habitat must have survived.) Other Withering records from suburbs of Birmingham such as Edgbaston and Winson Green are also cited. There are also species recorded outside the Birmingham area for which all the records appear to be old but which are merely described as 'very rare', without further comment (e.g. *Hottonia palustris*, *Pulicaria vulgaris*).

The contrast between Lees book and the standard Floras is instructive. It suggests that Purchas & Ley, Amphlett & Rea and Bagnall were not particularly concerned with change, and did not design the format of their Floras with this in mind.

#### FLORAS OF COASTAL COUNTIES, 1860–1914

Most of the scattered references to change in other county Floras published between 1860 and 1914 cover the same causes as those discussed in more detail in the preceding sections. One additional theme is that of changes in coastal habitats. Arnold (1887, p. xii) noted that in Sussex "owing to the encroachments of the sea ... many well-known localities for plants, as notably, Pilsey Island, are fast disappearing, and the coast line at Bognor, Brighton, Newhaven, and elsewhere, is undergoing considerable change". In the Isle of Wight and Hampshire development was also a threat. "The botanist may search in vain for many species entered in this Flora as growing on the Dover at Ryde. Even in Dr. Bromfield's time this ground was already being encroached on by building ... and since then the town has still further spread in this direction ... The same may be said of Royal Heath and the neighbourhood of Sandown; also of Portsea Island,

&c.” (Townsend 1883, p. xxiii). In Kent, the botany of the northern portion of the long stretch of blown sand between Deal and the mouth of the River Stour “has been greatly interfered with by the extensive golf links near Sandwich” (Hanbury & Marshall 1899, p. xxxi).

An even greater degree of change affected the coasts of N.W. England. As in Sussex, erosion and building operations affected the coast of the Wirral in Cheshire, and although some of the erosion may have been natural, other stretches of coast were “readily undermined by the strong current now cast on this shore in consequence of the continuous line of works erected on the Liverpool side” (De Tabley 1899, p. lxix). In West Lancashire the coast from Blackpool to Lytham, until about 1875, “was truly a botanist’s paradise ... The sand dunes were then practically undisturbed and, in the neighbourhood of where St. Annes now stands, extended a considerable distance inland. They formed a high belt rising along the shore ... On the land side of these dunes were flat stretches of boggy and sandy marsh, whilst inland again were more sand-hills and marshes succeeding one another and intermixed. The boggy hollows formed beautiful natural gardens, filled during the summer with a wealth of flowers delightful to behold; and in them also grew many rare plants and mosses, unnoticed by the ordinary passer-by, but of fascinating interest to the botanist. It is painful to think that many of these have now gone and none of the old marshy ground remains in its original condition! Where not already built upon it is ‘improved’ and drained and given over to crowds of excursionists or converted into golf links” (Wheldon & Wilson 1907, p. 34). Elsewhere on the West Lancashire coast the construction of the Ribble Docks had led to the loss of extensive salt-marshes. Even a stretch of sea-cliffs supporting *Asplenium marinum* was completely removed when a dock was constructed at Heysham near Morecambe, and “the district being much over-run by excursionists, very few interesting plants are left except such as are either inconspicuous or out of reach” (p. 25).

#### INTER-WAR AND POST-WAR FLORAS, 1914–1960

Only 13 Floras published between 1914 and 1960 are included in this study. They show, in general, a greater tendency to mention change in the introductory material, and usually include lists of extinct species (Table 1). Druce (1926, pp. xlv–lxviii), for example, refers to various developments which have affected the Buckinghamshire flora. These include disafforestation, the enclosure of commons, the drainage of marshland, the spread of the London suburbs and other building developments and the subsequent use of brickpits for what would now be called land-fill. In addition to such general comments, a few of the Floras provide a more detailed treatment of particular changes, and some of these are considered below.

#### *Agricultural improvement of grassland in Leicestershire*

The county of Leicestershire was predominantly pastoral in the inter-war years, and its grasslands are treated by A. R. Horwood, in Horwood & Noel (1933), from an agricultural as well as a botanical viewpoint (pp. xxvi–xxx). In reviewing a list of the weeds of grassland drawn up in the early 19th century, Horwood says that “the elimination of a large proportion of them including the beautiful Cowslip [*Primula veris*], Green Winged Orchid [*Orchis morio*], Moonwort [*Botrychium lunaria*], Adder’s Tongue [*Ophioglossum vulgatum*], &c., has already been accomplished over a large proportion of the grasslands of Leicestershire by the free and repeated use of chemical concentrates, or fertilizers, such as basic slag, &c.”. Most of the grassland was (agriculturally) excellent, and many upland meadows in S. and E. Leicestershire “were once covered with ant-hills, but they have gradually been improved”. Nevertheless, “there are ... some pastures on heavy Lias Clays that have not been drained that need to be vastly improved, especially those with very marked ridge and furrow”. In the more calcareous grassland on limestone and chalky boulder-clay “the aggressive and successful Tor Grass, *Brachypodium pinnatum*” was a problem for both farmers and botanists. “It is too hard and harsh for live stock ... Little else grows where Tor Grass is dominant. Such plants as *Anemone Pulsatilla*, *Asperula cynanchica*, *Astragalus danicus* are in danger of extinction where Tor Grass runs riot”.

#### *Development of the Sussex coast*

Wolley-Dod (1937, pp. xii–xxiv) discusses change in Sussex with reference to the seven botanical divisions into which he divides the county. Change in the coastal habitats of the county is particularly apparent in his text. In the West Rother Division, “the changes in the flora ... are chiefly at its sea-edge and the maritime plain”. “The steady erosion of the coastline which has been

going on for ages and is still taking place” was the most significant cause. In other divisions, building development, the increase in summer holiday-makers and the construction of holiday homes “of a slight and temporary nature” figure more prominently. In the Cuckmere Division, the “extension of Eastbourne, from the times of the earliest botanists, has been very great ... the large modern town covering many of the old botanical sites. ... Building is now extending on the Crumbles ... a celebrated spot for botanists. Most of its rarities still survive but appear doomed. Beyond this, almost as far as Pevensey Sluice, the littoral portion becomes yearly more overrun in late summer and autumn by tents and temporary dwellings of holiday-makers, so that even if they do not gather its flowers, they trample them out of recognition, and perhaps out of existence. *Crepis foetida* is disappearing from this cause. East of Bexhill building is now almost continuous to St. Leonards ...”. The flora of Rye Harbour and Camber (East Rother) “has been celebrated for its rarities. Now, unfortunately, bungalow dwellers and their inevitable associations are rapidly destroying the whole of that area and part at least of its flora seems doomed. The Rye Golf Club have now enclosed a portion of the ground where several rare species grow; this it is hoped may preserve them.” It is interesting that golf clubs were regarded as threats to the natural coastline by Hanbury & Marshall (1899) and Wheldon & Wilson (1907), but by 1937 a golf club appeared to Wolley-Dod to be the only hope of saving the Rye area from the greater threat of building development. The unplanned development of the Sussex coast, as described by Wolley-Dod, attracted national attention. Farmers were happy, during a period of agricultural depression, to sell land to development companies and this led to ribbon development along cliffs and highways. On the coast, “weekend residents from the 1890s erected any building that took their fancy, from disused railway carriages and tramcars to the more sophisticated structures resembling verandahed dwellings adopted by the English in India” (Brandon 1974, p. 262). Most of these beach shacks were cleared at the onset of the Second World War, but such unplanned developments attracted the strong disapproval of local authorities and were one of the factors leading to modern planning legislation (Hardy & Ward 1984).

In inland Sussex, Wolley-Dod cites road-widening as the chief modern change in the West Rother Division. “The construction, widening and ‘improvement’ of roads” is also cited in W. H. Pearsall’s Preface to C. E. Salmon’s posthumous *Flora of Surrey* (1931) as one cause of the loss of plants from their former localities.

#### *Wartime changes in Ashchurch, Gloucestershire*

Changes brought about by the Second World War were foreshadowed by Wolley-Dod (1937), who reported that “the island of Thorney, which is celebrated as the home of several rare species, is about to be taken over by the Royal Air Force, and will no doubt lose at least some of its rarities”. After the War C. W. Bannister contributed to the *Flora of Gloucestershire* (Riddelsdell *et al.* 1948, pp. lxxxix–xciii) a detailed study of the impact of war-time changes on a small area in the north of the county. (There is little in the introductory material in this Flora dealing with changes in the county as a whole, perhaps because, as Allen (2003) relates, the flora took 71 years to complete.) “Before the War, arable land was practically non-existent” in Bannister’s area, the parish of Ashchurch, “and most of the area consisted of rather rough, poor, ill-drained pasture. During the War years, however, very extensive ploughing took place, and now the area of arable is far greater than that of pasture. Also much draining was carried out, and waste and scrubland cleared.” Not surprisingly, this led to the appearance of arable weeds previously unknown in the district. “Of these, the sudden appearance and extremely rapid spread of *Ranunculus arvensis* was most spectacular”. Many other arable species “present before the War, have increased enormously and considerably extended their area”; these included *Kickxia elatine* and *K. spuria*. There had been a corresponding decline in grassland species, mostly “abundant plants, found also on roadsides and similar places ... A few more uncommon species, however, have been practically wiped out, notably *Genista tinctoria* and *Orchis morio*, both of which were abundant in several localities before the War.” Summarising the changes, Bannister concluded that “it is good to know that, in this district at least, our native species, more beautiful than the majority of the ‘weedy’ newcomers, have not suffered more severely during such a period of upheaval”.

## DISCUSSION

## SCOPE OF THE STUDY

Although the county Floras included in this survey provide a manageable group of books for study, they only represent a small proportion of the publications which might be examined for evidence of the way in which botanists have perceived floristic change. Local Floras might be well worth studying, and there may also be much relevant material in national and local journals. The more restricted scope of the local Floras, and the greater informality of papers in many journals, could provide insights that are missing from the county Floras. A study of the references to alien species in county Floras and other works would complement this paper, and might also be illuminating.

## HOW HAVE AUTHORS RECOGNISED FLORISTIC CHANGE?

There are three lines of evidence which the author of a Flora might draw upon to assess change:

*1. Extrapolation from current events*

If certain species are characteristic of certain habitats and there are obvious changes in these habitats, an author might well conclude that floristic change was occurring. If, for example, pastures are being ploughed up to create arable fields he might conclude that grassland species are declining and that cornfield weeds may be increasing. He wouldn't, in this case, need any botanical records to do so.

*2. Personal experience*

An author, if long-resident in his county, might witness changes over his own lifetime. This evidence might be supplemented by the memories of botanical colleagues.

*3. Evidence from botanical records*

The third and most obvious source of data on floristic change is the botanical records of an author's predecessors.

These categories grade into each other, and it is particularly difficult in practice to separate the first category from the second. It is striking how many of the examples of floristic change discussed in county Floras are based on personal observations in these two categories. Lees' (1867) description of change in Worcestershire, Wolley-Dod's (1937) remarks on the despoliation of the Sussex coast and Bannister's (1948) Gloucestershire study are some of the most vivid descriptions of change, and draw to a large extent on their own experience. Although Lees and Wolley-Dod had historic records available to them, these only supplement their own observations. One of the more remarkable examples of the use of personal experience is Druce's (1926, p. xix) discussion of the disafforestation of Whittlebury Forest, in which he is able to draw on his very early memory of a visit to the area when it was newly cleared of trees, probably in the late 1850s.

Some discussions of change do make full use of historic botanical records. These include Babington's (1860) treatment of Cambridgeshire, as he witnessed only the latter part of the agricultural change he described. However, in general it is notable that the authors of Floras do not tend to use historic records to illustrate floristic change, especially in a quantitative or semi-quantitative way. This remains true of county Floras today (Walker 2003b).

Rapid changes are much more likely to be apparent during a single lifetime than more gradual developments. The effects of radical changes in land-use might, for example, be more apparent than those resulting from long-term climate change. Gradual changes might only become apparent when plant records collected over a longer timescale are analysed, and might therefore have been overlooked in the historic period by the authors of county Floras.

## THE PROBLEM OF FLORAS THAT DON'T MENTION CHANGE

As change does not feature prominently in some of the standard county Floras published before 1914, it is easy to get the impression that our predecessors botanised in an almost unchanging countryside. However, there are numerous other reasons why an author might not mention floristic change, even if he was aware of it. He might simply lack the space to deal with it within the

physical constraints of his Flora. He might not be interested in the subject, or consider that it was not an appropriate one for a county Flora. Many authors model their Floras on an existing work, and an author might be following a model in which change was not considered. He might also exclude references to changes that were so familiar to him and his contemporaries that they did not need mentioning. Finally, some Floras are published posthumously and may not include introductory material which the author would have prepared if had he lived to complete the book.

In some cases it is clear that the lack of evidence of change in the Flora simply reflects the author's lack of interest in floristic change. The flora of Warwickshire was affected by the growth of Birmingham, however little attention was given to the subject by Bagnall (1891). In other cases it is unclear whether the absence of reference to change implies an absence of dramatic change. Was the flora of Worcestershire changing less drastically when Amphlett & Rea (1909) were active than in the days of Lees (1867)? Does the lack of reference to change in Herefordshire by Purchas & Ley (1889) indicate a stable countryside? These are difficult questions to answer. However, it is clear that the absence of reference to change should not be taken uncritically as implying an absence of change. Edwin Lees (1867, p. 120) may have been unusual amongst the authors of county Floras in thinking that "the changes continually taking place in local floras ... [form] one of the most interesting episodes in the science of botanical geography".

#### ASSESSING THE RATE OF FLORISTIC CHANGE

Sexual intercourse began  
In nineteen sixty-three  
(Which was rather late for me) –  
Between the end of the *Chatterley* ban  
And the Beatles' first LP.  
(Larkin 1974)

This quotation brilliantly encapsulates the attitude of many contemporary botanists to floristic change. Even if on reflection they accept that change must have occurred in the past, they regard developments in recent decades as quantitatively if not qualitatively different. Jones (1980, p. 5), for example, in her biography of Edwin Lees, comments that "the coming of the railways gave the gentlemen of the field clubs a mobility to explore, before the acceleration of change caused by technology and dense population destroyed the glory of the English countryside, and diminished so greatly its native flora". Reading the descriptions of change in earlier Floras is a salutary reminder that dramatic changes did occur in earlier centuries. It is particularly interesting to see references to changes such as the loss of species-rich pastures, the spread of *Urtica dioica* and the decline of *Populus nigra*, all changes one might suppose had taken place (or, at least, first been recognised) in recent decades. There is little *prima facie* evidence to suggest that change has proceeded at an accelerating rate in all areas. The statistics on plant extinction in Cambridgeshire set out by Preston (2000), for example, do not appear to suggest a gradually accelerating process of floristic change over the last 250 years.

Little attempt has been made to devise direct measurements of the rate of floristic change in England during the historic period. Only recently have attempts been made to look critically at the way in which the rate of extinction of species in vice-counties has changed over time (Preston 2000; Walker 2003a). If further, preferably more detailed, measures could be devised, it might be possible to test whether change is an accelerating process. Are alternative models more appropriate? Might floristic change, at least in some areas, be an episodic phenomenon, with periods of rapid change followed by periods when the rate of change slowed?

There is also considerable scope for bringing together estimates of the extent of floristic change and data on agricultural and other land-use history such as those summarised by Collins (2000), Thirsk (1984) and Turner (1980). Are there reasons to believe that floristic change in 19th century Cambridgeshire was more marked than in Suffolk or Hertfordshire? Was Worcestershire changing more rapidly than Herefordshire in the same period? A consideration of other lines of evidence could do much to help interpret the valuable but fragmentary record of floristic change provided by the authors of county Floras.

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