Problems in reconstructing floristic change: interpreting the sources for English grazing marshes

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ABSTRACT

In attempting to reconstruct floristic change in three English grazing marshes, a wide variety of sources, both published and manuscript, were employed. These sources cannot be used uncritically as though they represented points on a uniform monitoring scheme. The sources vary in 1. their objectives; 2. the scale and type of recording, including the basic recording unit employed; 3. the evenness of the coverage achieved, both taxonomic and geographical; and 4. in the precision or accuracy of the information included.

KEYWORDS: botanical recording, county flora, manuscript source, taxonomy, wetland.

INTRODUCTION

Many authors have attempted to trace the changing status of plant species over recorded history, using a wide variety of published and archive sources (e.g. Driscoll 1982; Sheail & Wells 1980; Wade 1983). There are fundamental problems in using data as disparate as anecdotal jottings and systematic surveys to reconstruct change in species distribution and vegetation type. The concept of recording area, changing understanding of the taxonomy and the rigour and motivation of the observer all affect the quality and quantity of the data on plant distribution, posing problems in their interpretation by modern students (Stott 1981).

The present paper describes some of the difficulties encountered in attempting to assess changes in the flora of three English grazing marshes since 1840: 1. the Somerset Levels and Moors; 2. the Romney and Walland Marshes; and 3. the Idle/Misson Levels (Mountford & Sheail 1989). The distribution and abundance of 526 species of vascular plant and species of Charophyte were investigated through a search of published and manuscript sources (Mountford 1994). Information on species distribution extracted from these sources was ordered by species and then compiled in chronological order. The sources employed in that study could not be regarded as representing parts of a uniform monitoring scheme. There was great variety in the objectives and methodology adopted in gathering the data both within and between study areas and from recorder to recorder. Some of the apparent trends over time in species abundance may thus be discounted as artefacts. To some extent, inconsistencies or inaccuracies could be identified by comparing different sources, but care had to be exercised in either rejecting or accepting data. Four major problems can be recognised in the interpretation of these data, arising from: a. the purposes of the survey; b. its unit of recording; c. the evenness of coverage; and d. the accuracy of the information. In practice, these problems are inter-related and strongly influenced by the motivation of the botanist which can introduce a bias into the survey (Rich & Woodruff 1992).

PROBLEMS IN THE INTERPRETATION OF SOURCES

PURPOSES OF THE SURVEY

Botanists have carried out surveys for widely varied reasons. When he set out to prepare an *Atlas of the Kent flora*, Philp (1982) wanted to ensure that every species was fully mapped. The smallest gap in the map of the distribution of an otherwise ubiquitous species was to be examined. He hoped to

motivate botanists to fill these gaps. However, if the gap should prove genuine, that absence might provide an insight into the ecology of that species (E. G. Philp, pers. comm. 1981).

The motives of Victorian naturalists, keeping day-books of interesting finds, were very different. Many considered their own personal total, or that of their vice-county, to be more important than the fine detail of species distribution. Some Flora writers sought only to prove a species' presence in their county, division or parish. Other authors expected the published work to be simply a guide to visitors intent on finding interesting plants. More recently, authors hoped to understand the ecology of species, and gathered considerable environmental and community data to supplement those on distribution (Graham 1988; Rose MS; Sinker *et al.* 1985).

THE UNIT OF RECORDING

The purpose of the survey usually determined the basic recording unit employed, if any. The nature and size of this unit in turn affect the detail of the study and its compatibility with other studies, particularly if the modern student seeks to make comparisons between surveys. In recent years, the greater number of botanists, and particularly their increased mobility, has meant that more ambitious surveys, with smaller units of recording, can be attempted.

However, Flora writing and recording schemes have often been the province of the true amateur, and botanists have often found it easier to identify with the county or parish than the grid square. A vice-county and parish recording scheme may result in more enthusiastic and competent recording than the monotonous working of grid squares (Allen 1983). The parish approach may still be justified in the 1990s, since it allows direct comparison to be made with the nineteenth century accounts (D. A. Wells, pers. comm 1990).

The accurate reconstruction of floristic change ideally requires some measure of abundance to accompany the distributional data. A parish or tetrad record as published may reflect a single specimen in a precarious locality or a common species which is an important part of the local vegetation. This detail is seldom available except in an anecdotal form, and underlines the present need for systematic and regular site monitoring to measure environmental change (Hill & Radford 1986).

The vice-county, drainage basin and civil parish were used as recording units from the mid-nineteenth century Floras to the more modern studies of Nottinghamshire (Howitt & Howitt 1963) and Somerset (Roe 1981). There are weaknesses in the use of such units for recording due to their variable size and their tendency to include several contrasting types of topography. Parish boundaries were often originally set so as to include a variety of landscapes which could provide the crops, livestock, fuel and fisheries that the community required. In addition, the prevalence of winter flooding on the levels meant that villages mainly occurred on the upland fringe with the parish extending out into the grazing marsh from there, as along the Polden Hills in Somerset (Havinden 1981). Particularly in the grazing marshes, therefore, a parish is rarely confined to one soil or landscape type. Interpreting the past species distribution in terms of environmental variation may not be straightforward. For instance, the parish of Bonnington in Kent is almost equally divided between the Romney Marsh and the undulating, often wooded land to the north. It is not always possible to determine whether a record for 'Bonnington' refers to the grazing marsh, the upland, or to both. Specifically, an ancient woodland species is almost certain to be confined to the upland and a macrophyte of deep, still water is likely to be restricted to the grazing marsh. Species of wet grassland, however, could occur in either type of landscape.

In some cases, greater precision in recording was achieved with the introduction of the 10-km square and later the 2-km square 'tetrad' of the National Grid as standard recording units. For example, *Ranunculus flammula* L. was said to be "common and generally distributed" in Kent in the late nineteenth century (Hanbury & Marshall 1899). Modern atlases show it to be absent from the chalk and coastal marshland (Perring & Walters 1976; Philp 1982). It is possible that *R. flammula* has disappeared from the grazing marshes (and chalk) over the last century. However, it is more likely that the authors of *Flora of Kent* decided to publish a summary account, rather than give a lengthy list of parishes, thus disguising local but important gaps in the distribution of *R. flammula*. Although maps of 10-km square records can reveal patterns in geology, climate or altitude, much environmental variation is not revealed by such a coarse grid.

The 10-km square represents a large (and often varied) block of land e.g. ST/3.4, north of the Polden Hills in Somerset, includes parts of 19 civil parishes. In an attempt to assess the impact of

land use change in the Idle/Misson Levels, it was important to include only records from west of the River Trent and south of the River Torne, since this was the area to benefit from the upgrading of drainage pumps at West Stockwith (Mountford & Sheail 1985; Severn-Trent Water Authority 1974). The study area included parts of 10-km grid squares SE/6.0 and SK/8.9. The *Atlas of the British flora* (Perring & Walters 1976) records many wetland species for these two squares which other archive sources and modern field survey indicate are absent from the study area proper. SE/6.0 includes parts of Potteric Carr and other well-recorded sites (Lees 1888), whilst SK/8.9 includes Laughton and Scotton Commons east of the Trent, which have had a diverse, but now impoverished, wet heath and bog vegetation (Gibbons 1975). Changes in these sites are irrelevant to a study of the Idle/Misson Levels.

At present, the tetrad is the preferred unit of recording for many county Floras and smaller projects (Crackles 1990; Hall 1980; Philp 1982). Tetrad maps are at a scale where broad soil and land-use patterns may emerge, showing those wetland species that are now typical of the grazing marshes e.g. *Eleocharis palustris* (L.) Roemer & Schultes, and those that are not, e.g. *Filipendula ulmaria* (L.) Maxim. (Philp 1982). With caution, the historical record may then be re-interpreted.

EVENNESS OF COVERAGE

From early accounts of each study area, it is clear that some sites acted as 'honey-pots' for botanists, whereas others, perhaps adjacent, were seldom visited. Botanists were (and still are) tempted to pursue new species for their own personal lists at reliable localities. This was particularly the case in the era of the Exchange Clubs when gathering material to trade with fellow botanists was an incentive. It was comparatively rare for botanists to seek out unvisited sites especially if, as in the instance of the levels, such areas had a reputation for monotony. For example, the Trent division of West Yorkshire was neglected by botanists who went instead to Potteric Carr (Don division) for wetland plants (Lees 1888). Similarly in Nottinghamshire, there were few records for the Misson and Misterton areas until J. W. Carr began his work at the end of the nineteenth century (Howitt & Howitt 1963). In Kent and Sussex, botanists crossed the Romney and Walland Marshes to visit and revisit the Denge Beach with the wetlands around the Open Pits (Rose MS). Whole counties may have been under-recorded in the past, whether due to a lack of botanists or of perceived interest (Wells 1989).

Sometimes accessibility led to areas being recorded preferentially (Sheail 1982). Many early records for the Somerset peat moors are in the Ashcott and Shapwick areas where the Somerset and Dorset Joint railway made it a simple task for botanists to visit the turbary peats (Marshall 1914; Murray 1896). Although now known to have a rich flora, West Sedgemoor is rarely mentioned in the records until the 1910s and 1920s when easier transport allowed Dr W. Watson and other botanists to reach more remote sites (Sandwith files). Access may still influence the data gathered (Rich & Woodruff 1992).

Thus many 'new' records, produced by modern systematic mapping, reflect the discovery of plants at sites that had not previously been visited rather than a genuine spread in range. Uneven coverage can also result from the lack of observers needed to record a large county. There have been many more active naturalists is Kent, Sussex and Somerset than in the counties making up the Idle/Misson area. Tetrad atlases require considerable personnel and some species patterns shown may simply reflect the absence of recorders in some areas. When using diverse sources to reconstruct floristic change in grazing marshes, it had to be assumed that the description 'widespread and common' implied an even and abundant distribution throughout the area, unless other sources contradicted that interpretation (Mountford 1994).

Even within a single source, sites may be listed with uneven precision. For example, Hanbury & Marshall (1899) both observed *Sium latifolium* L. in the Romney Marsh study area. Hanbury noted it as: ". . . abundant in trenches by the roadside, between Ham Street and Ivychurch, and by the military canal". This site can be located on modern maps and visited to confirm its presence. Marshall recorded *S. latifolium* "near Appledore", implying that it grew in Appledore parish, but making precise relocation impossible.

Herbaria present particular opportunities and problems as a source of historical plant records. They allow the modern student to assess the accuracy of past information, by providing corroborative evidence to the contemporary day-books (Sheail & Wells 1980). However, herbaria frequently suffer from uneven coverage of species, focusing on rare or taxonomically interesting

plants. There may be many sheets of a species from classic sites, confirming its continued presence. There is little systematic gathering of common species, with the result that not only can their past status rarely be demonstrated but also important infraspecific variation may remain unrecognised (P. D. Sell, pers. comm. 1981).

ACCURACY OF INFORMATION

No two botanists will record exactly the same species in the same numbers at the same site. These differences are exaggerated when records are made at different times (Kirby *et al.* 1986). Botanists are not immune from error and opinions on taxonomy change. It is not always certain that what a Victorian writer intended by a species or by a site name is identical with what would now be understood.

The same population may be identified as several different taxa over a number of years. In addition to *Potamogeton pectinatus* L., three species of narrow-leaved pondweed proved widespread in field recording of grazing marsh ditches for the present study: *Potamogeton berchtoldii* Fieber, *P. pusillus* L. and *P. trichoides* Cham. & Schldl. Botanists have been confused as to what was meant by the Linnaean name *P. pusillus*, and at different times the other two species have been named as variants of *P. pusillus*. The name *P. panormitanus* Biv. was also applied to one or more of these pondweeds. In Somerset, a population at Baltonsborough was variously labelled *P. pusillus* (vars '*pseudotrichoides*' and *tenuissimus* Koch), *P. trichoides* and '*P.* × *franconicus*' until examination of material in the Cambridge University Herbarium from 1881 and modern recording identified it as *P. berchtoldii* (Murray 1896; Marshall 1914 – author's annotated copy; Roe 1981 and Roe files).

Distinct species may be confounded and botanists record two or more species as one taxon. This is clearly the case with the Water-Speedwells: *Veronica anagallis-aquatica* L. and *V. catenata* Pennell. Most post-1950 records for Water-Speedwells on the grazing marshes are referred to the pink-flowered V. *catenata* (Hall 1980; Howitt & Howitt 1963; Philp 1982; Roe 1981). *V. catenata* is hardly mentioned in the records covering the study areas before the Second World War, although it was described as distinct in 1921 (Pennell 1921). Marshall recorded *V. anagallis-aquatica* in a "pretty form, bearing white flowers tinged with pink" at Headcorn and Westenhanger Castle in Kent (Hanbury & Marshall 1899), which may have been *V. catenata*, but this assumption simply begs the question as to why he did not record it on the Romney Marsh where it is widespread. The earlier records all refer to one taxon, variously named *V. anagallis-aquatica*, *V. anagallis* L. or *V. aquatica* Bernh. The two species do sometimes occur together and hybridise (*V.* × *lackschewitzii* Keller), but *V. catenata* is confined to open, muddy sites with little or no water flow, whilst *V. anagallis-aquatica* has a much wider range, often occurring by streams. Taken at face value, the historical data suggest a huge expansion in the population of *V. catenata* with a proportionate decline in *V. anagallis-aquatica*. Clearly this has not been the case and no assertions as to changing abundance in the Water-Speedwells can be made from the historical record. However, not all instances of confusion are so apparent and real population change may be hidden.

In contrast, variation in one species may be interpreted as the presence of two or more species. The Creeping Forget-me-not (*Myosotis secunda* A. Murray) was noted in several of the early accounts of the Somerset flora:

1. Clevedon; Nailsea Moor; Yatton; Bourton, ditches nearby (Murray 1896).
2. Tickenham Moor; dykebanks near Portbury; moors near Wells (White 1912).
3. North Newton (Marshall 1914).

The only recent Somerset records for *M. secunda* are from the Blackdown Hills, the Bredon Hills, Exmoor, the Quantock Hills, Chard Common and sparingly on the Mendip sandstones (Roe 1981). None of the records for the Levels and Moors have been substantiated and it appears likely that forms of *Myosotis scorpioides* L. were mistakenly identified as the upland species (Roe 1981). As with *Veronica anagallis-aquatica*, the apparent decline of *M. secunda* is an artefact of changed understanding of the taxonomy.

Flora writers in different periods have included a different range of taxa. Some authors included records of *Salix* bushes where they may have been originally planted or derived from cultivated osiers, whilst others rigorously excluded them (listing only clearly native sites). Some authors avidly recorded aliens (e.g. *Azolla filiculoides* Lam.), others did not mention them until they became

thoroughly established or confine their attention to native species (Rich & Woodruff 1992). Aliens (e.g. *Elodea nuttallii* (Planchon) H. St John) that resemble established species (e.g. *E. canadensis* Michaux) may be overlooked until their identity is clear. In 1982, *E. nuttallii* was observed in 10% of the watercourses sampled in the Somerset Levels and Moors, particularly in larger, more nutrient-rich rhynes and drains (Mountford & Sheail 1984). Previously it had been recorded once, in 1981, but the assumption must be that it had been overlooked for some years.

It would be wrong to imply that present workers are more accurate or observant than those of the past. Indeed the opposite may be true. Between 1850 and 1950, many hybrids and infraspecific taxa were noted that probably still occur in the grazing marshes, but which many modern recorders dismiss as specimens that do not quite fit the specification for the taxon. Reconstruction of floristic change from 150 years of botanical recording might seem to indicate the disappearance of many hybrids and varieties – a highly unlikely event.

The time span over which data were gathered may become a source of error. In the 'Plant Atlases' for Kent (Philp 1982) and Sussex (Hall 1980), records are only included from a period of ten or twelve years, thus giving an impression of the flora at one time. In the early Floras records dated as much as 50 years apart may be listed side by side, without distinction. In the particular case of Lincolnshire, the absence of a nineteenth century work impelled Gibbons (1975) to take stock of the flora from the beginnings of botanical recording. Thus records in *The flora of Lincolnshire* from the Isle of Axholme (embracing the Epworth and Wroot parts of the Idle/Misson study area) include those of Peck (1815) and those derived from her own studies. Gibbons was very careful to distinguish such records, but where the aim of the researcher is to trace trends over time, there may be some confounding of the data.

CONCLUSIONS

Reconstruction of floristic change from published and archive sources requires a critical approach. Sources vary in nature, scope and accuracy. Variation in the quality and quantity of data produces spurious trends in abundance over time, which must be identified as doubtful or discounted in any assessment of the scale of change. Data for 526 species were compiled from three English grazing marshes between 1840 and 1990 (Mountford 1994). Of the 34 species increasing in distribution, there was significant doubt in the trend for 18. Similarly, where decreasing species are considered, 46 of the 269 could not be definitely said to have declined. Thirdly, there were many species among the 526 studied where the sources provided an ambiguous or varied impression, such that the species had to be assumed to have remained unchanged in abundance or distribution since 1840.

Problems encountered in the use of such a wide range of sources may be summarised thus:

1. Botanists gathered information for widely different reasons – approaches including both systematic mapping and anecdotal records in day-books.
2. The method and standard unit of recording (if any) changed from 1840 to 1990. The size of the recording unit varied, and for the first 100 years was not standard.
3. Abundance information was often not noted – a species was simply recorded as present.
4. Coverage of an area was uneven in time and space. Some areas were recorded eagerly, others were neglected.
5. The systematic recording of 10-km or 2-km squares partly ensured a more thorough coverage of an area.
6. The accessibility of parts of the study areas changed with time, affecting the information gathered.
7. Where a species was recorded as 'widespread and common', subsequent recording cast doubt on whether it genuinely had been ubiquitous.
8. The identification and understanding of species' taxonomic limits and the names by which sites are labelled varied greatly over the period of study.
9. The range of taxa recorded varied over the 150 years and between recorders. There was particular variation in the quantity and quality of information available for alien, critical, infraspecific or hybrid taxa.

10. Particular sources may include information gathered over a long period, making the identification of trends in time difficult.

The problems described in this historical investigation of grazing marshes are similar to those met in contemporary studies of plant distribution (Rich & Woodruff 1992). In contrast to the *Atlas of the British flora* (Perring & Walters 1976) and the B.S.B.I. Monitoring Scheme, however, the sources used in this study could not be considered as part of a planned whole. The reconstruction of floristic change must make use of the data available, in all its variety. The investigator cannot influence the type or accuracy of data gathered post hoc but must be discriminating in which data are now used and how they are interpreted.

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REFERENCES

ALLEN, D. E. (1983). Vice counties: a defence. *B.S.B.I. News* **34**: 36.
CRACKLES, F. E. (1990). *Flora of the East Riding of Yorkshire*. Hull.
DRISCOLL, R. J. (1982). The dyke vegetation at Oby and Thurne: a comparison of the late nineteenth century and recent records. *Transactions of the Norfolk & Norwich Naturalists' Society* **26**: 43–49.
GIBBONS, E. J. (1975). *The flora of Lincolnshire*. Lincoln.
GRAHAM, G. G. (1988). *The flora and vegetation of County Durham*. Durham.
HALL, P. C. (1980). *Sussex plant atlas*. Brighton.
HANBURY, F. J. & MARSHALL, E. S. (1899). *Flora of Kent*. London.
HAVINDEN, M. (1981). *The Somerset landscape*. London.
HILL, M. O. & RADFORD, G. L. (1986). *Register of permanent vegetation plots*. Institute of Terrestrial Ecology, Huntingdon.
HOWITT, R. C. L. & HOWITT, B. M. (1963). *A Flora of Nottinghamshire*. Privately published.
KIRBY, K. J., BINES, T., BURN, A., MACKINTOSH, J., PITKIN, P. & SMITH, I. (1986). Seasonal and observer differences in vascular plant records from British woodlands. *Journal of Ecology* **74**: 123–131.
LEES, F. A. (1888). *The flora of West Yorkshire*. (Botanical Transactions of the Yorkshire Naturalists' Union **2**.) London.
MARSHALL, E. S. (1914). *A supplement to the Flora of Somerset*. Taunton.
MOUNTFORD, J. O. (1994). Floristic change in English grazing marshes: the impact of 150 years of drainage and land-use change. *Watsonia* **20**: 3–24.
MOUNTFORD, J. O. & SHEAIL, J. (1985). *Vegetation and changes in farming practice on the Idle/Misson Levels (Nottinghamshire, Humberside and South Yorkshire)*. I.T.E. Project 718, C.S.T. Report No. 633. Nature Conservancy Council, Huntingdon.
MOUNTFORD, J. O. & SHEAIL, J. (1989). *The effects of agricultural land use change on the flora of three grazing marsh areas*. Nature Conservancy Council, Peterborough.
MURRAY, R. P. (1896). *The flora of Somerset*. Taunton.
PECK, W. (1815). *Topographical account of the Isle of Axholme*. Doncaster.
PENNELL, F. W. (1921). *Veronica* in North and South America. *Rhodora* **23**: 29–41.
PERRING, F. H. & WALTERS, S. M., eds. (1976). *Atlas of the British flora*, 2nd ed. Wakefield.
PHILP, E. G. (1982). *Atlas of the Kent flora*. Maidstone.
RICH, T. C. G. & WOODRUFF, E. R. (1992). Recording bias in botanical surveys. *Watsonia* **19**: 73–95.
ROE, CAPT. R. G. B. (1981). *The flora of Somerset*. Taunton.
ROE, CAPT. R. G. B. Notes, files and card index of Somerset records.
ROSE, F. *Ecological Flora of Kent*. (Unpublished MS.)
SANDWITH, N. Y. Notes, files and card index for period 1912–1965. [Held by Prof. A. J. Willis, Sheffield University.]

SEVERN-TRENT WATER AUTHORITY (1974). *River Idle. A report on the feasibility of pumping the river Idle at West Stockwith.* Nottingham.

SHEAIL, J. (1982). Wild plants and the perception of land-use change in Britain: an historical perspective. *Biological Conservation* **24**: 129–146.

SHEAIL, J. & WELLS, T. C. E. (1980). The Marchioness of Huntly: the written record and the herbarium. *Biological Journal of the Linnean Society* **13**: 324–330.

SINKER, C. A., PACKHAM, J. R., TRUEMAN, I. C., OSWALD, P. H., PERRING, F. H. & PRESTWOOD, W. V. (1985). *Ecological Flora of the Shropshire region.* Shrewsbury.

STOTT, P. (1981). *Historical plant geography.* London.

WADE, P. M. (1983). Changes in the aquatic macrophyte flora of the Snowdonia lakes, north Wales: 1726 to 1983. *Proceedings of the International Symposium on Aquatic Macrophytes*, pp. 282–286. Nijmegen.

WELLS, T. C. E. (1989). The effect of changes in land use on the flora of Huntingdonshire and the Soke of Peterborough in the period 1949–89, in WELLS, T. C. E., COLE, J. H. & WALKER, P. E. G., eds. *40 years of change in the county*, pp. 10–20. Huntingdonshire Fauna & Flora Society, Huntingdon.

WHITE, J. W. (1912). *The flora of Bristol.* Bristol.

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