

Shropshire's bryoflora in the first decade of the 21st century

The first decade of the 21st century saw a considerable surge in what is known and vouched of Shropshire's bryoflora, with 88 species added or restored to the vice-comital list, raising it from 445 to 533 species. How did this increase of one in six come about? Why was it possible? What do these developments tell us about Shropshire's bryoflora, the ways in which it has been investigated, and what may remain to be found in future?

One might conclude from these figures that Shropshire's bryoflora is changing wholesale, but nothing could be further from the truth. Of the 20% increase in the county's known bryoflora

in the last 10 years, changes in the amount and kind of bryological recording in Shropshire over the years probably account for nearly all of the additions and restorations to the vice-comital list. These species had been overlooked, rather than previously absent, and their addition or restoration to the list signify changes in what we know of Shropshire's bryoflora, rather than changes to the flora itself. Very few species were probably formerly absent, and have arrived in the county for the first time comparatively recently, representing changes in the county's bryoflora: *Cololejeunea minutissima*, *Colura calyptrifolia*, *Platygyrium repens*, and perhaps *Tortula amplexa* and *T. freibergii*.

By extending back in time to include the first half of the 20th century, we might add *Campylopus introflexus*, *Hennediella stanfordensis* and *Orthodontium lineare* to this list of adventives, as well as a couple more epiphytes that atmospheric pollution had eliminated in the late 19th century: *Uloa phyllantha* and perhaps *Orthotrichum striatum*.

On the other hand, in contrast to Shropshire's gains or losses of species, changes in distributions and abundances of species within the county have been little studied. 1,945 new hectad records (a 33% increase from 5,950 to 7,895) were made in the first decade of the 21st century, but nearly all these apparent changes to distributions are

Mark Lawley, vice-county recorder for Shropshire (v.-c. 40), takes us on a journey through the last 10 years of bryology in this region, summarizing what has been learnt, looking at how this new knowledge has been gained and speculating on what the future may hold.

◁ The Long Mynd, Shropshire. *Xiaoqing Li*

▽ *Tortula amplexa*. *Des Callaghan*



also probably attributable to increased recording rather than increases in ranges or abundances. In addition to the small number of bryophytes that have recently arrived in Shropshire for the first time, a few other species have certainly become commoner within the county and spread across Shropshire (as in much of the rest of lowland Britain) during the 20th century: *Campylopus introflexus*, *Didymodon nicholsonii*, *Henediella stanfordensis*, *Orthodontium lineare*, *Nowellia curvifolia*, and numerous epiphytes – *Dicranum montanum*, *D. tauricum*, *Platygyrium repens* and *Ulota phyllantha*.

Why have so many species either appeared anew, or appear to have reappeared?

The reasons espoused below for why so many species have been added or restored to Shropshire's list overlap each other; for example, *Colura calyptrifolia* is very small as well as rare, and *Jamesoniella undulifolia* is not only rare, but also very like and could therefore be overlooked as *Odontoschisma sphagni*.

1. Rarities

Some species are undoubtedly rare in Shropshire. The mosses *Pterygoneurum ovatum*, *Rhabdoweisia crispata*, *Seligeria donniana*, *Tortula amplexa*, *T. freibergii*, *Weissia longifolia* var. *angustifolia*, *W. rostellata* and *W. squarrosa*, and the liverworts *Barbilophozia atlantica*, *B. kunzeana*, *Cephalozia pleniceps*, *Colura calyptrifolia*, *Fossombronina foveolata*, *Gymnomitrium obtusum*, *Jamesoniella undulifolia*, *Lepidozia cupressina*, *Riccardia palmata*, *Scapania aspera* and *Targionia hypophylla* occur in only one or a very few localities, and in small quantities.

These species live in comparatively stable habitats, and have probably been in Shropshire for many a long year, waiting to be discovered, rather than having recently arrived. Indeed, Edward Williams found *Targionia* a couple of



△ *Barbilophozia kunzeana*. Michael Lüth



△ *Grimmia orbicularis*. Ron Porley



△ *Scapania paludicola*. Sam Bosanquet

centuries ago (probably in the same place that it was rediscovered in the 21st century), and John Bishop Duncan found it at a second site 100 years ago. This liverwort's rediscovery in Shropshire at the beginning of the 21st century does not signify that it had left the county between the dates of these three records, or that it may be another 100 years before it is seen again.

2. Species that are very similar to other species

Rarities were doubtless overlooked because they occur in very few places or in small quantities, or both. However, numerous other species were overlooked because they are very similar to other species and not consistently distinguished. These include the mosses *Aloina ambigua*, *Anomobryum concinatum*, *Barbula convoluta* var. *sardoa*, *Brachythecium mildeanum*, *Bryum algovicum* var. *rutheanum*, *B. archangelicum*, *B. creberrimum*, *B. donianum*, *Dicranum scottianum*, *Ephemerum serratum*, *Grimmia orbicularis*, *Hypnum imponens*, *Philonotis caespitosa*, *Plasteurhynchium striatulum*, *Racomitrium sudeticum*, *Rhynchostegiella curviseta*, *Sphagnum teres*, *Thuidium assimile*, and *Weissia longifolia* var. *angustifolia*.

Liverworts that were probably overlooked for the same reason are *Barbilophozia atlantica*, *B. kunzeana*, *Cephalozia pleniceps*, *Fossombronina caespitiformis*, *Jamesoniella undulifolia*, *Lejeunea lamacerina* and *Scapania paludicola*.

A subset of species that are so similar to other species that they were not distinguished as distinct until comparatively recently include the mosses *Bryum ruderales* (tuberous *Bryum* species were not distinguished until the mid-20th century), *Didymodon tomaculosus* (a diminutive weed of arable fields), *Fissidens celticus* (formerly confused with other small *Fissidens* species), *Hedwigia ciliata* (usually indistinguishable from *H. stellata* in the field), *Pohlia bulbifera*, *P. camptotrachela* and *P. drummondii* (as with tuberous *Bryum* species, bulbiferous species of *Pohlia* were not fully understood until the second half of the 20th century), *Racomitrium ericoides* (formerly not distinguished from *R. elongatum* and *R. canescens*), *Schistidium apocarpum*, *S. crassipilum* and *S. elegantulum* (another genus that has only recently been disentangled) and *Tortella bambergeri* (confused with *T. tortuosa*), and the hepatics *Conocephalum salebrosum* (intergrading with *C. conicum*), *Metzgeria*

consanguinea (confused with *M. violacea*), *Phaeoceros carolinianus* (only differing from *P. laevis* in being monoicous) and *Plagiochila britannica* (intermediate between *P. asplenoides* and *P. porelloides*).

3. Very small, inconspicuous species

Other species were probably overlooked because they are very small and inconspicuous. These include the mosses *Amblystegium confervoides*, *Ditrichum pusillum*, *Ephemerum recurvifolium*, *Seligeria donniana*, *Tetradontium brownianum* and *Tortula freibergii*, and the liverworts *Cladopodiella francisci*, *Cololejeunea rosettiana*, *Colura calyptrifolia* and *Fossombronina incurva*.

4. Species which were overlooked because very little recording occurred in the 20th century

The surprisingly large number of restorations to Shropshire's list during the last 10 years is partly a tribute to the expertise and explorations of Benson, Hamilton, J.B. Duncan and others in the late 19th and early 20th centuries, and partly attributable to a lack of further exploration after Duncan left the West Midlands in the 1920s. This local decrease in the amount of attention given

to natural history between the 19th century and middle years of the 20th century exactly mirrors the national picture (Lawley, 2009).

In addition, though, the large number of additions to the county's list of species not previously recorded and vouched reflects how much nevertheless remained to be discovered after Duncan's departure. Mosses which were not found and revouched until long after they were first vouched are *Campylophyllum calcareum*, *Dicranum fuscescens*, *Didymodon acutus*, *D. spadiceus*, *Fontinalis squamosa*, *Polytrichastrum longisetum*, *Pylaisia polyantha*, *Racomitrium aquaticum*, *R. sudeticum*, *Rhabdoweisia crispata*, *Tetraplodon mnioides*, *Tortula marginata* and *T. protobryoides*. Liverworts in this category are *Metzgeria conjugata*, *Microlejeunea ulicina*, *Plagiochila spinulosa*, *Saccogyna viticulosa* and *Scapania gracilis*. Although liverworts and hornworts constitute 28% of the British and Irish bryoflora, they account for 38% of the additions to Shropshire's bryoflora in the first decade of the 21st century because Benson and Hamilton both died before MacVicar's *Handbook* first appeared in 1912, so they had no hepatic equivalent of Dixon's *Handbook of British Mosses*, and therefore concentrated more on finding and identifying mosses than liverworts.

5. Other species were probably overlooked because they grow in under-recorded habitats

We too readily, anthropocentrically, and arrogantly assume that a species which has just been found must have arrived in the district recently. This is particularly true of species that live exclusively in disturbed habitats. Riverbanks, arable fields, and other disturbed sites were traditionally neglected by many bryologists, so *Ditrichum pusillum*, *Pterygoneurum ovatum*, *Syntrichia virescens*, *Weissia longifolia* var. *longifolia*, *W. rostellata* and *W. squarrosa*, and

the hepatics *Fossombronia caespitiformis* and *Phaeoceros carolinianus* have probably been patiently waiting to be found in Shropshire since time immemorial.

Tortula amplexa was first noticed (I nearly wrote 'first turned up', but stopped myself just in time) in Britain in a working clay pit in Leicestershire, and bryologists therefore suggested (because this moss was not known in Europe outside its favoured pit) that it may have arrived with machinery imported from America by the pit's owners. This seemed a reasonable assumption until 2007, when *T. amplexa* was found on a riverbank in Worcestershire (a year after also being found in a working pit in Shropshire). Discovery on the riverbank came well after its original discovery in a working pit, so thereafter we regarded *T. amplexa* as capable of spreading from pit to riverbank. But is it? We cannot be sure that *T. amplexa* first arrived in Britain at a clay pit in Leicestershire. Maybe *T. amplexa* first arrived on a riverbank and spread into pits because conditions there suited it. After all, it's not as if Britain teems with bryologists equipped with an accurate search image of *T. amplexa*, and who scour riverbanks for this little moss. *Hennediella stanfordensis* is another tuberous acrocarp of disturbed soil that has spread far and wide along the riverbanks of the West Midlands, and thence on to damp soil banks beside paths and tracks, and similar places. Will *T. amplexa* behave in a similar fashion in years to come?

Aquatic and semi-aquatic species are also likely to be overlooked because not all bryologists paddle about in water to examine the banks and beds of streams and rivers. *Fissidens rivularis*, *F. rufulus*, *Hyocomium armoricum* and *Fossombronia foveolata* may have been overlooked until recently for this reason. Again, Victorian and Edwardian bryologists did not clamber onto

the roofs of churches and other buildings to look for *Grimmia laevigata*. Perhaps well-aimed blows from the vicar's tongue were sufficient to dissuade bryologists, but not bryophytes. And to what extent might difficulty of access to private land hinder or prevent discoveries?

6. Species that have recently spread into Shropshire

A few species were probably not found in Shropshire until recently because they have recently spread into the county. Several epiphytes have recently appeared in (or spread back into) Shropshire for the first time: *Orthotrichum striatum* (a reappearance, rather than a first record), *O. tenellum*, and the liverworts *Cololejeunea minutissima*, *Colura calyptrifolia*, and *Microlejeunea ulicina* (the last named also a reappearance, if indeed it ever left). In common with *Dicranum montanum*, *D. tauricum*, *Platygyrium repens* and *Ulotia phyllantha*, they have probably prospered as a result of less



polluted air. However, the liverworts may also have flourished as a result of milder winters. No one knows whether the extents to which their spreading across the county are consequences of reduced pollution, milder winters, a combination of these two factors, or of other influences as well.

Why have other species not appeared or 'reappeared'?

Conardia compacta, *Mnium marginatum*, *Orthotrichum rupestre*, *Plagiothecium latebricola* and *Polytrichastrum alpinum* may not have been refound and vouched recently because they are uncommon, or because they have continued to be passed over as similar species, or both.

Platydictya jungermannioides and *Rhabdoweisia fugax* are (or were) very rare in Shropshire, but may equally have been overlooked recently because they are so small. *Plagiobryum zieri* was probably always very rare in Shropshire (i.e. in very small quantity at only one site), so may have been eradicated by changes in conditions there. *Tomentypnum nitens* and *Campylopus setifolius* may never have been found in Shropshire, for their Salopian vouchers are of doubtful provenance.

Splachnum ampullaceum may be a victim of altered husbandry, for although grazing stock remain plentiful on the hills, many upland mires have been drained, and dung tends not to persist in comparatively aerobic conditions. *S. ampullaceum* therefore cannot complete its life cycle. Alternatively or additionally, has the recent use of anthelmintic parasiticides for sheep and cattle also reduced populations of stercoraceous invertebrates that spread the spores of *Splachnum*?

Antitrichia curtipendula is probably susceptible to atmospheric pollution and been unable to

◁ *Splachnum ampullaceum*. Gordon Rothero

spread back into the Midlands now the air is cleaner again. On the other hand, *Neckera pumila* and the leafy liverworts *Blepharostoma trichophyllum*, *Frullania fragilifolia*, *Marsupella funckii*, *Tritomaria exsecta* and *T. exsectiformis* may reasonably be expected to turn up again (and indeed, *T. exsectiformis* subsequently did so in 2010). *Orthodontium gracile* has probably succumbed to its alien, more competitive congener *O. lineare*. *Tortula wilsonii* has also become much rarer during the last 100 years, and may have fallen victim to changing conditions, although we do not know which ones, or why.

How does Shropshire's bryoflora compare with those of contiguous counties?

One means of putting Shropshire's bryoflora into context is to compare and contrast it with surrounding counties. The figures in the table below are for numbers of species vouched (Hill *et al.*, 2008), including those that have not been vouched since 1960.

Vice-county		No. of species		
No.	Name	Mosses	Hepatics	Total
36	Herefordshire	383	107	490
37	Worcestershire	348	95	443
39	Staffordshire	325	108	433
40	Shropshire	397	126	523
43	Radnorshire	376	121	497
47	Montgomeryshire	392	132	524
50	Denbighshire	411	140	551
58	Cheshire	337	102	439

The average number of mosses in these eight counties is 371, with 116 hepatics, making an overall average of 487 bryophytes. Denbighshire has most species (13% above average) because it contains very varied habitats, with considerable

▷ *Riccardia palmata*.
Des Callaghan

high ground as well as low-lying land. High ground remains wetter than low ground for longer periods, enabling species which cannot withstand more prolonged desiccation to survive there. The same applies to Montgomeryshire (7.6% above average), whereas Radnorshire is not only a smaller county, but lacks both really high ground and several lowland habitats (for example, there is very little arable ground in the county). Nevertheless, Radnorshire is also probably far from fully recorded. Herefordshire is low on liverworts (e.g., *Bazzania trilobata*, *Cephalozia connivens* and *C. lunulifolia*, *Lophozia sudetica*, *Riccardia multifida*, *Scapania gracilis* and *Trichocolea tomentella* all require to be revouched), Staffordshire and Worcestershire are probably comparatively under-recorded, but they do also lack higher ground, except for the Staffordshire moors.

The counties encircling Shropshire not only differ in their environments, but have also benefited (and suffered) from different qualities and quantities of recording. So species that are present in one county may not occur in another, or alternatively be present but not recorded. For example, Shropshire is a march on the Celtic fringe, intermediate between the high rainfall and rocky valleys of pastoral Welsh hills and the flatter landscapes and arable fields of England's Midland plane. Shropshire therefore contains species that favour moist conditions and are prominent in Welsh counties to the west as well as species characteristic of disturbed, low-



lying ground and therefore likely to occur in neighbouring counties of the English Midlands. Several of the species that favour moist or wet conditions are less frequent in Shropshire than further west, where more rain falls and the ground and air are less likely to dry out, or dry out for fewer, shorter periods. Examples are the mosses *Dicranum scottianum* and *Diphyscium foliosum*, and the liverworts *Lejeunea lamacerina*, *Lepidozia cupressina* and *Riccardia palmata*. For the same reason, many species that can only survive in districts of high rainfall do not occur in Shropshire.

Conversely, Shropshire has numerous species that have not been found in mid-Wales, where greater rainfall, shallow soils, fewer arable fields, faster-flowing rivers and streams, and fewer outcrops of limestone rock all limit the occurrence of species. Shropshire shares many ruderal bryophytes and numerous calcicoles with its neighbouring English counties, whereas these species are scarce in or absent from Radnorshire, Montgomeryshire and Denbighshire. Of other species that seem to have found difficulty in crossing the border from England into Wales, the epiphyte *Platygyrium repens* is an interesting example. On the English side of the border it favours damper sites in woodland, for example

near watercourses in dingles, and grows on a variety of tree species, so one might expect *P. repens* to thrive in Wales, but it does not seem to do so. Perhaps, like *Dicranum tauricum*, *P. repens* eschews very wet districts.

It would also be interesting to know how many records have been added to counties contiguous with Shropshire during the same period of time. This would shed further light on how the effect of recording activity compares with other factors such as changes of habitat or the distributional status of particular species.



△ *Platygyrium repens*. John Birks

Which species have never been found in Shropshire, but may occur?

This is rather like noting the last cuckoo of the year; how can one know what is being overlooked? Several dozen species have never been discovered in Shropshire, but may reasonably be expected to occur. Indeed, one sometimes feels there may be an inexhaustible supply of additional species waiting to be discovered.

Scores of species have been vouched from one or more of the seven vice-counties that abut Shropshire, but not from Shropshire. Of these, *Lophozia incisa* has been vouched from all seven contiguous counties. Six of the surrounding counties have *Hygrohypnum ochraceum*, *Mylia taylorii*, *Preissia quadrata* and *Scapania umbrosa*, but none of these species are vouched from Shropshire. Five of the surrounding counties contain the liverworts *Scapania scandica* and *Solenostoma sphaerocarpon*, and the mosses *Andreaea rothii* subsp. *falcata*, *Bryoerythrophyllum ferruginascens*, *Dicranella subulata*, *Dicranodontium denudatum*, *Isopterygiopsis pulchella*, *Orthothecium intricatum*, *Plagiopus oederianus*, *Splachnum sphaericum* and *Sphagnum girgensohnii*. And four counties contiguous with Shropshire have the liverworts *Cephaloziella stellulifera*, *Nardia compressa*, *Solenostoma obovatum* and *S. paroicum*, along with the mosses *Drepanocladus sendtneri*, *Grimmia hartmanii*, *Gymnostomum calcareum*, *Hennediella heimii*, *Pohlia cruda*, *Schistidium platyphyllum*, *Seligeria pusilla* and *Tortella nitida*.

Apart from the 28 species named above, my 'most likely suspects for being absent without leave' also include the 8 hepatics *Anastrophyllum minutum*, '*Aneura maxima*' (only recently recognized as distinct from *A. pinguis*), *Anthoceros punctatus*, *Lophocolea semiteres* (spreading), *Phaeoceros laevis*, *Scapania subalpina*, *Sphaerocarpos michelii*, and *S. texanus*, and the 13

mosses *Bryum pseudotriquetrum* var. *bimum* (less often identified than formerly), *Campyliadelphus elodes*, *Grimmia decipiens*, *G. dissimulata* (only recently distinguished as a species), *G. longirostris*, *G. ovalis* (fairly frequent on sandstone roof tiles to the south-west of Shropshire), *Gymnostomum viridulum* (close to the county's border with north-west Herefordshire), *Herzogiella seligeri* (probably overlooked as other Hypnales), *Hygroamblystegium humile* (doubtless overlooked in wet woods), *Hygrohypnum eugyrium* (J.B. Duncan found it in Shropshire early in the 20th century), *Sematophyllum substrumulosum* (no one realized until recently that this moss occurs in Britain, and may be overlooked as *Rhynchostegium confertum*), *Sphagnum subsecundum* (infrequently distinguished from similar species) and *S. warnstorffii*. I think it very likely that a majority of these 49 species are present in Shropshire, even though no one has yet vouched them.



◀ *Jamesoniella undulifolia*. Fred Rumsey

It is all very well choosing likely candidates for jumping onto the county's list, but several of the species that have been added to Shropshire's known bryoflora during the last decade were entirely unexpected (particularly *Tortula amplexa*, *Barbilophozia kunzeana* and *Jamesoniella undulifolia*), so it seems likely that the unlikely will continue to appear. Indeed, the 'new' species found in the first few months of 2010 (and therefore too late to be included in this review of the preceding decade), are not listed in the paragraph above.

A salutary lesson is the discovery of additional species at sites that were regarded as having already been thoroughly explored. The rocky outcrops, wet hollows and flushes on the Long Mynd received considerable bryological attention from Benson, Hamilton, Duncan and numerous other bryologists in the late 20th century, and yet additional species are still turning up. The rare liverwort *Jamesoniella undulifolia* appeared in a

small mire on Nover's Hill in 2009, and when Nick Hodgetts went to see the *Jamesoniella* he also found *Barbilophozia kunzeana* new to Shropshire. *B. kunzeana* also appeared in another flush on the Long Mynd a few days later, *Cephaloziella pleniceps* came to notice in another flush, and *Scapania paludicola* appeared

at yet another site, along with *C. pleniceps* and *Jamesoniella undulifolia*.

This well shows how naturalists with different search images may find species that others have missed. Indeed, I worry that I am the only bryologist who regularly reports bryophytes from Shropshire, for my blind spots for recognizing particular species may come to increasingly skew corporate understanding of which species occur in the county – and which apparently do not. This contrasts with recording of more popular groups such as flowering plants, birds and butterflies, for which one naturalist's shortcomings may be compensated by the strengths of others who visit the same sites. Like many other bryologists, I take more interest in searching for (and pleasure in finding) some bryophytes than others, and have not tried to find and identify the varieties *Atrichum undulatum* var. *gracilisetum*, *Bryum canariense* var. *provinciale*, *Fissidens taxifolius* var. *pallidicaulis*, *Hypnum lacunosum* var. *tectorum* or *Polytrichum commune* var. *perigoniale*. Nor have I looked for *Dichodontium flavescens* or *Bryum bornholmense*, or consider *Sphagnum* as my long suite.

Preston *et al.* (2009) regard Shropshire as currently well-recorded, but I think of Shropshire only as better recorded than at the end of the 20th century, and better recorded than some neighbouring counties. Even these qualifications – one in time and the other in space – are relative and not definitive distinctions. How well is 'well-recorded'? This will forever remain a matter of opinion, but I counsel caution in making claims about being well-recorded while several species continue to be added to the vice-comital bryoflora in each year that people continue to look. And it probably remains possible to at least double the number of species that have hitherto been recorded in most hectads within Shropshire, so the prospect of white gaps on spotty maps

becoming as meaningful as the adjacent black dots remains as far-distant as ever.

It is essential to know which species occur, in what quantities, and whether they are increasing or declining to accurately assess which species most urgently merit being conserved, and where and how this may best be attempted. However, much more comprehensive information about the occurrences and abundances of mosses and liverworts in Shropshire must first be obtained to understand which species merit conserving in the county. With one in six species added or restored to Shropshire's known bryoflora in the last decade we clearly remain well short of a comprehensive inventory of species in Shropshire. Moreover, we have at best crude, inaccurate and incomplete notions of species' geographical distributions and biomasses within the county. We are at present therefore poorly placed to decide how best to conserve which bryophytes in Shropshire, and nearly all the current talk and effort about conserving species will for some time to come be better directed at assessing which are present and in what quantities.

It is much more than a refined debating point to expose presumed changes in Shropshire's bryoflora during the first decade of the 21st century as being for the most part apparent (indeed mainly illusory) rather than real. For less well-known groups such as bryophytes, we must first do a lot more recording and identifying before we can decide appropriate priorities for gardening the wild. The priority to record before deciding what to conserve does not apply to well-studied groups such as vascular plants, birds

and butterflies, for which we have much more complete information about their occurrences and abundances.

Truly, a bryologist's work is never done. There remains humbling scope for adding further to what is known about the bryofloras of Shropshire and its neighbouring counties, and I hope to be able in future to read equivalent accounts of how interpretations of other counties' bryofloras have been changing.

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▷ Habitat of *Jamesoniella undulifolia* and *Barbilophozia kunzeana* on Nover's Hill, Long Mynd, looking north-east to The Lawley (central hill) and The Wrekin in the distance. Xiaojing Li