Reports of BBS meetings

Throughout the following section, new vice-county records are indicated with an asterisk (*). Nomenclature aims to follow Blackstock *et al.* (2005).

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AGM and Bryological Symposium 2006, Hatfield

Agneta Burton

School of Life Sciences (Division of Geography and Environmental Sciences), University of Hertfordshire, Hatfield AL10 9AB; m.a.burton@herts.ac.uk

The Annual General Meeting and Bryological Symposium were held at the new DeHavilland campus of the University of Hertfordshire on 8th-10th September 2006. The Symposium was attended by 44 people and it was a pleasure to have a number of new members, and others who had not attended an indoor meeting before, as well as members from across England, Scotland, Wales and two from mainland Europe. Some additional locally-based participants joined for the Sunday field excursion. Abstracts of the papers, provided by the speakers, are presented below.

After an extremely dry summer in the East of England provided a challenge of finding a suitable site for a field excursion, which was ably met by Alan Outen whose account of the excursion can be found at the end of this account.

Bryological Symposium

The general theme included a number of papers on bryophytes and environmental change, with presentations on experimental and field approaches to examining responses to change and for conservation purposes. In addition, presentations based on field records from home and abroad, both recent and from the past, were used to illustrate concerns and theories about species distributions. The Conversazione on Saturday evening provided an opportunity to examine and comment on poster displays of designs for the forthcoming BBS Field Guide as well as research posters, listed in the penultimate part of this account.

Climate change and ultraviolet radiation: effects on stream bryophytes

Javier Martínez-Abaigar and Encarnación Núñez-Olivera
(Universidad de La Rioja, Logroño, Spain)

Ultraviolet (UV) radiation is the part of the solar spectrum extending from the X-rays to the visible/photosynthetic region. For biological purposes, the UV radiation is divided into three bands: the lethal UV-C (100-280 nm), the mostly harmful UV-B (280-315 nm) and the more innocuous UV-A (315-400 nm). The stratospheric ozone layer absorbs completely UV-C and thus protects the living organisms against its destructive effects. However, the protection against UV-B is only partial, and thus a certain amount of UV-B reaches The Earth's surface. UV-A is hardly influenced by the amount of ozone in the atmosphere. The amount of UV-B received depends not only on diverse natural factors (solar elevation, altitude, clouds, aerosols and albedo), but also on the anthropogenic depletion of the ozone layer caused mainly by emission of halocarbons. The ozone depletion is especially dramatic in the Antarctic continent, but significant ozone losses occur in the Arctic and mid-latitudes as well (5-12% since 1980). It is estimated that a 1% ozone loss causes a 1-2% increase in UV-B. An excessive UV-B exposure may cause damage to living organisms. In humans, the most common health risks affect skin and eyes. In photosynthetic organisms, UV-B causes damage to DNA and alterations in photosynthesis, growth and development.

In the context of UV research, bryophytes may be interesting because they are structurally simple and lack structural defences against UV-B (hairs, thick cuticles and epidermis). This could result in a higher UV-B sensitivity of bryophytes, as a group, in comparison with vascular plants. Bryophytes from mountain streams are particularly exposed to the effects of UV-B radiation because UV-B increases with altitude and can easily reach organisms, given that they live at relatively low depths. In addition, cold temperature limits metabolism and consequently the development of protecting mechanisms against UV-B, such as antioxidants, DNA repairing systems, and synthesis of UV-absorbing compounds (these compounds would act in a similar way to melanin in humans).

The vast majority of the research about the effects of UV-B on photosynthetic organisms has focused on terrestrial cultivated plants and marine phytoplankton and macroalgae. Bryophytes in general, and those from rivers and lakes in particular, have received much less attention. Because of the scarcity of studies and the controversial results found, our first objective is to increase our knowledge on the responses of bryophytes to UV-B radiation. Also, we are trying to elucidate if bryophytes may be useful as bioindicators of the present levels of UV-B and of the presumably higher future levels of UV-B that could be reached as a consequence of ozone depletion. We circumscribe this research to aquatic bryophytes from mountain streams.

Our methodological approaches include laboratory and field studies. In the laboratory, UV-B is enhanced by adequate lamps to simulate 20% ozone depletion, and the bryophyte responses have been assessed through morphological variables (colour and symptoms of cell degradation), and physiological ones: the state of the photosynthetic apparatus (concentration of chlorophyll and carotenoids, pigment indices showing vitality, photosynthesis rates, and chlorophyll fluorescence kinetics), respiration rates, DNA damage, protein level, accumulation of UV-absorbing compounds, sclerophylly index (the relationship between mass and area of bryophyte shoots), and growth. We have studied mainly two species: the moss *Fontinalis antipyretica* and the liverwort *Jungermannia exsertifolia* subsp. *cordifolia*. The most remarkable results obtained by our group will be briefly explained.

1. The effects of UV-B on aquatic bryophytes depend on the species, and thus bryophytes do not constitute an homogeneous functional type with respect to their responses to UV-B (Martínez-Abaigar *et al.*, 2003, 2004). *Fontinalis antipyretica* is a relatively sensitive species and the exposed samples show severe morphological and physiological alterations, whereas *Jungermannia cordifolia* is a relatively UV-B tolerant species and it only shows a slight decrease in growth and the maximum quantum yield of PSII (F_v/F_m), together with DNA damage. The different sensitivity of both species could be partly explained by the higher accumulation of UV-absorbing compounds in the liverwort.

2. The effects of UV-B on aquatic bryophytes depends not only on the species, but also on environmental factors such as temperature (Núñez-Olivera *et al.*, 2004). The stressing effects of cold and UV-B may be additive in the UV-B-sensitive *Fontinalis antipyretica*, given that low temperatures limit the display of repair mechanisms. However, in *Jungermannia cordifolia* the interaction of cold and UV-B is less evident. We also tested the interacting effect of cadmium and UV radiation in this liverwort (Otero *et al.*, 2006). Cadmium caused stronger stress than UV. Physiological damage was generally intensified by the combination of cadmium and UV, but this intensification depended on the variable considered. In these cases when a great number of variables has to be analyzed, the use of multivariate tools like Principal Components Analysis

may clarify the effects of the different treatments and factors.

3. The effects of UV-B on aquatic bryophytes depend not only on the species and the environmental factors, but also on intraspecific differences depending for instance of the previous acclimation to sun or shade conditions (Núñez-Olivera *et al.*, 2005). Shade samples were more UV-B-sensitive than sun samples, but only in the UV-B-sensitive *Fontinalis antipyretica*, whereas in *Jungermannia cordifolia* there was no difference between both types of samples.

4. In the field, the absorption spectra in the UV region of ten mosses and four liverworts growing at 2000 m altitude were obtained (Arróniz-Crespo *et al.*, 2004). In the liverworts, high UV-absorbance and clearly hump-shaped spectra were found, whereas low UV-absorbance and almost flat spectra were generally found in the mosses. Thus, liverworts and mosses may develop different protecting mechanisms against UV-B radiation.

5. Also in the field, 11 populations of *Jungermannia cordifolia* growing along a natural altitudinal gradient of UV-B from 1100 to 1800 m altitude showed considerable changes in their physiological variables, but only a few ones showed significant correlations with altitude (Arróniz-Crespo *et al.*, 2006). Among these, the global concentration of UV-absorbing compounds increased with altitude, but only two out of five individual compounds were responsible for this increase: the new caffeic acid derivatives 5”-(7”,8”-dihydroxycoumaroyl)-2-caffeoylmalic acid and 5”-(7”,8”-dihydroxy-7-O-β-glucosyl-coumaroyl)-2-caffeoylmalic acid. These compounds may confer protection against UV-B, and thus the liverwort would not be affected by the increasing UV-B along the altitudinal gradient. In addition, the two new compounds could be used as indicators of spatial changes in UV-B. Could they also be used as bioindicators of the temporal changes in UV-B levels caused by anthropogenic ozone depletion?

6. For bioindication purposes, adequate variables and species should be selected. Useful variables may be F_v/F_m because of its sensitivity, and UV-absorbing compounds and DNA damage because of their specific response to UV-B. With respect to UV-absorbing compounds, the measurement of the concentration of individual compounds by HPLC has more physiological relevance than the usually employed bulk UV absorbance of plant methanolic extracts, given that each compound may respond in a different manner to UV. Among the species studied, *Jungermannia cordifolia* is our most preferred species, and the concentration of its UV-absorbing compounds may be a promising bioindication tool. These can be the ecophysiological bases to establish in the future a bioindication net of the potential anthropogenic UV-B increase based on aquatic bryophytes.

Acknowledgements

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Mosses as bioindicators of nitrogen inputs in the environment

[1,2]Catherine Cooke, [1]John Pearson, [2]Tony Miller ([1]University College London, [2]Rothamsted Research, Harpenden)

Anthropogenic nitrogen (N) deposition from burning fossil fuels, applying fertilisers and growing legumes has resulted in an unnatural accumulation of N in atmospheric, terrestrial and marine environments. Recent research, such as the GANE (Global Nitrogen Enrichment) initiative, into N deposition effects has shown trends towards long-term environmental change.

Following on from research into the foliar uptake and assimilation of N in bryophytes the rapid initial induction of nitrate reductase activity (NRA) was investigated further using inorganic-N in both *Mnium hornum* and *Sphagnum fimbriatum*. From this work N-status models of both mosses were established over time.

Mnium hornum had a tremendous capacity to sustain itself with NRA being induced and NO_3^- stored long term even whilst undergoing N starvation. This moss was then used to test a hypothesis that *Mnium hornum* would be able to sense changes in atmospheric N deposition, perhaps serving as a useful bioindicator to measure changes in atmospheric N. This type of experiment had not been conducted before and after one month of fieldwork, *Mnium hornum* NRA and tissue NO_3^- concentrations recovered to levels found in the field at Mardley Heath.

Inputs from rainwater data revealed that critical loads for N were almost reached on several occasions on the site during that month however no detrimental effects to NRA or tissue NO_3^- concentration accumulation were observed on the N-starved mosses. It can be concluded that *Mnium hornum* can serve as a good bioindicator of atmospheric N pollution if NRA *in vivo* and tissue NO_3^- concentrations are measured in conjunction with one another. Living bioindicators also have the advantage of detecting interactions between environmental pollutants in this way.

Cryopreservation – a tool for conservation

JK Rowntree (Royal Botanic Gardens, Kew, Surrey)

Since 2000, the Micropropagation Unit at the Royal Botanic Gardens Kew has been host to a project funded jointly by English Nature, Scottish Natural Heritage and the Countryside Council for Wales for the *ex situ* conservation of threatened UK bryophytes. One of the aims of the project has been the development of methods for the long term storage of bryophyte material via cryopreservation; the storage of living tissue at -196°C in liquid nitrogen. A relatively simple encapsulation-dehydration protocol has been developed and tested on gametophytic material from a range of species with diverse ecological requirements. Recovery rates using a single protocol have been high, ranging from 68-100%. This is unusual and is attributed, in part, to the totipotency of bryophytic material (ability to regenerate whole plants from a single cell) and the inherent ability of bryophytes to overcome physiological stress. To date, twenty species of moss and one species of liverwort with threatened status in the UK have been successfully frozen. These are currently being held in the cryopreserved collection at Kew.

Recent changes in the Cornish bryophyte flora and their causes

David T. Holyoak (Camborne, Cornwall)

A project to record distribution of bryophytes in Cornwall and the Isles of Scilly has been underway since 1993, with over 77,000 records amassed by 2006. Recording is being carried out by tetrads (the 2 x 2 km squares of the National Grid). By 2006 good coverage at this scale had been obtained in West Cornwall (v.-c. 1), with data for >95% of tetrads, but there is still only patchy coverage of East Cornwall (v.-c. 2). Comparisons can be made with results of intensive surveys carried out by Mrs Jean A. Paton mainly during 1960-1968, from which detailed notes have now allowed most records to be assigned to tetrads.

Detailed quantitative analyses of changes in the bryoflora are planned when fuller coverage of East Cornwall has been achieved. In the meantime it is already apparent that there have been some large changes between the 1960s and the 1993-2006 period, with serious implications for conservation of some of the rarer bryophytes. Changes in land-use have had the greatest impacts, principally through abandonment of marginal land. This has involved cessation of grazing on coasts and total neglect of much old mining ground, resulting in many formerly open habitats being replaced by scrub. Conversely, agricultural intensification has occurred on higher ground of Bodmin Moor and the West Penwith moors, with drainage, fertiliser inputs and overgrazing of grasslands, resulting in loss or damage to mires, flushes and wet heathland.

Reduction of open habitats around the coasts has led to declines in several *Fossombronia* and *Riccia* species, including such rarities as *F. crozalsii*, *F. maritima*, *R. bifurca* and *R. nigrella*. Mosses of open coastal habitats have also declined, with some rarities badly affected, notably *Tortula canescens, T. cuneifolia* and *T. wilsonii*. *Weissia multicapsularis* has declined both inland and on the coasts, with the two small populations surviving on the south coast of East Cornwall now being all that are known worldwide. Despite official protection of some of the best areas, metalliferous mine sites are also suffering from increased scrub growth, even where over-grazing also occurs close by such as at Phoenix United Mine. Declining rarities on metalliferous sites include *Cephaloziella massalongi*, *C. nicholsonii*, *Pohlia andalusica* and *Scopelophila cataractae*. Mining effectively ceased in Cornwall many years ago, so that continuing declines of bryophytes requiring open mine-spoil habitats will be ineviteable unless habitats are kept open by deliberate conservation management work.

Agricultural 'improvement' of the Cornish moors has been in progress since the nineteenth century but it has tended to accelerate in the past few decades. Mechanical diggers now reduce the difficulties of draining wet ground, and artificial fertilisers are more easily spread over hill grasslands and heath, causing eutrophication of mires downslope. Since the 1960s the West Penwith moors have lost many of their sites for *Sphagnum* spp., but they remain unharmed on some parts of Bodmin Moor. Flush bryophytes have sustained great losses throughout Cornwall, especially those that were always scarce plants here because they require some base enrichment, such as *Calliergon sarmentosum* and *Scorpidium scorpioides*. *Splachnum ampullaceum* appears to have become extinct since the 1960s, presumably due to Ivermectins used as veterinary wormers reducing populations of the dung flies that disperse its spores. Over-grazing now threatens much of the heathland vegetation on Bodmin Moor but it keeps many of the valley bogs open. Current efforts by conservationists to reduce grazing pressure will probably result in recovery of some of the heather moorland, but lead to development of tall *Molinia* stands that will reduce the bryophyte interest of mires.

Compared to the effects of land-use changes, the impacts on the bryoflora of invasive alien species, pollution or climatic change seem relatively minor. The only alien bryophyte that has become widespread and locally abundant is *Campylopus introflexus*, which now blankets much open soil in heathland and on cliff tops that might previously have supported other species. In the Isles of Scilly the aliens *Lophocolea bispinosa* and *L. semiteres* are also colonising much open ground and both are now established on the mainland, the former now occurring extensively on areas of open china-clay spoil.

Possible effects of recent climatic warming have been much discussed, but they are not as yet striking in the bryoflora as a whole. Several species newly recorded in Cornwall are southern thermophiles (*e.g. Bryum valparaisense*, *Grimmia crinita* and the rapidly spreading *Didymodon umbrosus* and *Sematophyllum substrumulosum*) but others are not (*e.g. Didymodon tomaculosus*, *Distichium inclinatum*, *Grimmia hartmannii*, *G. orbicularis*, and *Plagiothecium cavifolium*). The clearest evidence of bryophytes responding to a warmer climate may come from *Cololejeunea minutissima* and *Colura calyptrifolia*, two small thermophilous liverworts that have ranges extending into the tropics. Both of these have increased greatly in Cornwall since the 1960s, when both were essentially coastal and the latter was known only on the Lizard peninsula. By 2000 both had colonised large areas inland, including high ground on Bodmin Moor where there is no doubt they were absent in the 1960s.

Causes of the changing abundance of several species remain uncertain. Several mosses that grow on open acidic rock surfaces have declined since the 1960s, this being especially obvious with *Andreaea rothii* and *Racomitrium fasciculare*, both of which are now very rare in West Cornwall even on the superficially undamaged rocky areas of the Land's End peninsula. Atmospheric sulphur pollution originating from shipping may have affected them, as might climatic warming.

Mosses and the African Plants Initiative: digitisation at the Natural History Museum, London

Jo Wilbraham (Natural History Museum, London)

The African Plants Initiative (API) is an international collaborative project to create an online database of herbarium specimen images and associated data, contributed by partner herbaria and funded by the Andrew Mellon Foundation in New York. The Natural History Museum (NHM) received funding in autumn 2005 to digitise the collection of moss type specimens from Africa and Madagascar (liverworts and hornworts are not included in this project). The NHM herbarium holds approximately 25,000 moss type specimens, 4,000 of which are from Africa and will be entered into the API database. The API website is set to launch in February 2007 and is going to be available to institutions by subscription. The subscription rates will work on a sliding scale to ensure affordability for partner institutions in Africa.

The moss herbarium at the NHM

The herbarium is a vast store of information about plant diversity and systematics. For many parts of Africa large numbers of allegedly endemic taxa have been described, often with poorly defined characters, and there are few floristic accounts of bryophytes. Identification of bryophyte collections may have to be made using only original descriptions (often published in obscure journals) and in some cases the type specimen is the only known collection. The type specimen is the singular entity on which the name of a plant is based and access to these specimens is imperative for taxonomic work. Information on the location and condition of type specimens is often hard to find and thus creates an impediment to taxonomic study.

Digitisation methodology

Type validation – As not all type specimens are marked up as such in the collections, some experience and a substantial library are required to identify original material. It has been necessary to work through all the folders of African specimens to locate type material though the time restrictions of the project limit the extent to which nomenclatural research can be undertaken.

Scanning specimens – The specimens are scanned using an inverted Epson 10,000 XL Expression Flatbed Scanner. The specimen sheet is placed on a platform that is raised up to the inverted scanner and scanned at 600 dpi, producing an image of approximately 200MB. Scanning specimens is preferable to photography as the latter leads to problems with resolution and extensive lighting requirements.

Associated label information – Specimen label information is recorded into a database and this data, along with the specimen images, is exported to the API administrative headquarters in New York.

Targets –The NHM has pledged to digitise 4,000 moss specimens in one year. We are now nearing the end of this project and are currently on target. (With this reckoning we could digitise the entire moss herbarium of approximately 800,000 specimens in only 200 years!).

Additional API activities at the NHM

Brian O'Shea has produced a complete checklist of moss names for Sub-Saharan Africa. This includes all current names, synonymy and *nomen nudum.* The checklist will be incorporated into the API website and a version will be downloadable as a Tropical Bryology Report. A searchable database, recording bibliographic information about plant collectors in Africa, is also being produced at the NHM. This data will be available through the API website and also through the museum in the near future.

The future

The next focus for this digitisation project is Latin America. Estimates suggest that the herbarium holds approximately 8,000 moss type specimens from *Index Muscorum* regions 'America 2–6', and the digitisation of these will be undertaken in a two-year project. The specimen images produced by the NHM for the API project will remain the property of the museum and will be available for use in future projects to increase accessibility to the collections.

Are urban bryophytes boring? Results from King's Lynn

Robin Stevenson (King's Lynn) and Mark Hill (CEH Monks Wood)

Urban bryophytes have been investigated by many researchers, especially on the European continent. In Britain, the most significant studies by Gilbert (1968, 1970, 1971) date from a time when air pollution was at its maximum. Reinvasion of epiphytes was noted in London as early as 1989 (Adams & Preston, 1992) and is now recognized as a widespread phenomenon, in the countryside as well as in towns.

There has hitherto been no systematic survey of the bryophytes of a British town, so that it is impossible to document change with any certainty. Indeed, the nature of urban bryophyte floras is not clear. To make a start with this problem, RS made a systematic survey of the bryophytes of King's Lynn, a medieval town with about 41,000 inhabitants near the mouth of the Great Ouse river in East Anglia. A square 5 km × 5 km was studied. This included almost all urban and suburban parts of the town, together with some surrounding countryside. Each 1 km square was visited on several occasions between 1999 and 2004, and its bryophytes were enumerated.

The bryophyte flora comprised 151 species, and its composition was tested against a set of hypotheses about urban bryophytes that have resulted from studies in continental Europe. Results show that several of the hypotheses are justified when applied to the town centre, but are not true of the suburban areas that surround it. In particular, the overall magnitude of the flora was exceptionally large for East Anglia. This result can be explained in part by the fact that ancient woodland is encapsulated within suburban King's Lynn and also by the presence of adjoining arable land. Our preliminary conclusion is that the town has added to local species richness by providing a range of urban habitats while having apparently little effect on adjacent woods and fields.

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Saying goodbye to our Arctic? The future of snowbed vegetation in Scotland

Gordon Rothero (Argyll)

Bryophyte dominated snowbed vegetation is one of the rarest habitats in the UK (probably restricted to less than 1000 hectares) and intuitively it must be the habitat most threatened by climate change. There are various types of snowbed vegetation in Scotland but here the term refers to those types where lower plants are dominant. In terms of the national vegetation classification this essentially means U11 (the *Polytrichum sexangulare – Kiaeria starkei* snowbed) and U12 (*Salix herbacea – Racomitrium heterostichum* snowbed). I am not particularly happy with U12 which included a number of stands with *Salix herbacea* which are not particularly chionophilous and prefer, naturally enough, to use the association I described in my survey in 1989-90, the *Marsupella brevissima – Anthelia juratzkana* snowbed, often termed the 'hepatic crust'. In addition the *Pohlia ludwigii* snowbed community I described should also be included, plus the associated meltwater springs and flushes.

Where do these snowbeds occur? The distribution picks out the higher hills, particularly the Cairngorms, the Ben Nevis massif and the Ben Alder area where snowbeds are frequent. In addition to these core areas, there are a number of other mountains with smaller snowbeds, the most important of which is probably Creag Meaghaidh but the list also includes Ben Lawers, the Affric hills and stretches north to Ben Wyvis and Beinn Dearg. There are broadly two sorts of snowbed. The most widespread are those in deep coires with craggy headwalls and block scree, typified by sites in the Ben Nevis massif. The other type of snowbed has a lesser amplitude of relief and finer substrates and such snowbeds are typical of the sites on the Cairngorm plateau. Obviously, there are many sites which combine some features of both these types.

How do they form? Fallen snow doesn't stay put – it is blown about by the wind and deposited on lee slopes in hollows, along 'cornice lines' and in coires, often to prodigious depths. It is worthwhile pondering the fact that winds can reach 275 kmh on Cairngorm, giving a lot of energy to shift snow. With the prevailing winds being SW to W, many of these accumulations are on slopes facing N round to E, slopes where insolation will be relatively low even in high summer. This means that melting is reduced and the snow patches persist, often into August and, in most years, some snow persists throughout the year. The formation of snow patches and their size is critically dependant on the extent of the catchment area, the area from which snow can be scoured – this is why the high plateaux of the Cairngorms and the Alder Forest are so important. Because the winds and topography are fairly stable, snow patches tend to form in the same places with the same pattern of melting year after year with resultant effects on the vegetation. The short snow-free season means that vascular plants struggle to persist and the competitive advantage is with bryophytes and lichens.

What interesting plants do we stand to lose? There are a number of species which have all or most of their British sites in snowbeds. Some of them, like *Polytrichum sexangulare*, *Kiaeria falcata*, *Kiaeria starkei* and *Marsupella brevissima* are common to virtually all snow beds and often form large stands. Most of the better sites will also have species like *Moerckia blyttii*, *Pleurocladula albescens*, *Marsupella condensata* and *Andreaea nivalis*, the latter sometimes in remarkable abundance. There are a number of extreme rarities associated with the snowbeds. *Marsupella arctica* has only two sites in Scotland, its only sites south of the Arctic. *Marsupella sparsifolia* and *Gymnomitrion apiculatum* also have only a handful of sites, usually with small populations, although both can be very hard to pick out in the field. *Andreaea blyttii* is somewhat more widespread but two rather more enigmatic *Andreaea* species (*Andreaea alpestris* and *Andreaea sinuosa)* seem to be more restricted. The flushes and mire areas associated with snowmelt also have their special species. They are often picked out by large stands of *Pohlia wahlenbergii* var. *glacialis* and may have cushions of *Scapania paludosa* associated with them and occasionally *Sphagnum riparium* and *S. lindbergii.*

What of the future? There is some evidence that change is already taking place in the hills. There has been a 0.4°C increase in temperature in Scotland since late 1960s; in these higher latitudes minimum temperatures have risen faster than maximum (+0.2°C and +0.1°C per decade, respectively). In the Cairngorms, comparison of mean monthly precipitation between 1941-1970 and 1961-1990 show some seasonal alterations, with a decrease in summer rainfall by 10-15% and an increase in winter precipitation of 5-10%. The effect on snow patches is rather more difficult to interpret but the general impression, certainly since the 1980s, is of fewer and smaller areas of snow persisting on the hills at the beginning of summer and some evidence from the Braemar area suggests that this trend was also apparent in the 1950s and 60s. More systematic surveys of snow patches have been made by Adam Watson of the Centre for Ecology and Hydrology (CEH) at Banchory for the past 10 years but this is not long enough to give any kind of pattern. No snow patches persisted through the summer to the next winter snows in 2003 and only one and two small patches persisted in 2004 and 2005 respectively, although in 2005 I saw a patch on Aonach Mor that was 100m long and 40m wide in late July.

The UK Climate Impact Programme (UKCIP) has published four alternative scenarios for change, which are essentially 'what-ifs' rather than predictions, but we can be certain that there will be change. The exact pattern may depend on such variables as the cooling effect of any slowing of the North Atlantic Drift. In the higher hills temperatures may be up by 1°C by 2020 and by 2°C by 2050 but some models predict that the degree of warming may be higher in the winter. All four scenarios envisage an increase in winter precipitation of some 10% in the Cairngorms but this is offset by a decrease in summer precipitation so that total precipitation remains within the bounds of normal variation.

Predicting the effect of these sorts of changes on snow patches is difficult. Increase in winter precipitation, at least initially, may mean greater snowfall to feed the snow patches but, as the proportion of winter precipitation falling as rain increases, snow patches could take a double whammy – less drifting snow and more melting between snow falls. There are other complexities – future winds are difficult to predict but the suggestion is that they will be somewhat stronger and so will shift more snow into the snow patch areas. How quickly falling snow accumulates and how long it persists are also affected by the temperature of the underlying soils, rocks and gravels and this can be critically affected by early frosts when the ground is snow-free. The durability of the snow-pack is also affected by the process of partial melting and re-freezing. On a brighter note – what melts snow patches in the summer is not hot sunshine but warm rain and a decrease in summer precipitation may mitigate things a bit.

Hard evidence of change in the snow bed vegetation is lacking and casual observation suggests that the extent of the vegetation now is little changed from that which I observed in 1989 and 1990. This is particularly true of the plateau type snowbed, typical of the Cairngorms, but some of the coire sites look to have a greater cover of vascular plants. Demonstrating change in the vegetation will require a long term monitoring programme and this is currently being planned. It is hoped that this programme will attract significant funding from Scottish Natural Heritage.

Changing distributions in a changing world

Fred Rumsey (Natural History Museum, London)

The dynamic nature of distributions is rarely acknowledged. Bryophyte distributions may be static; species persist through their precise adaptation to particular niches and indefinite life-spans and fail to spread more widely usually through reproductive incompetence. In an unchanged world we might have greater expectation for distributions at anything but the finest scale to remain essentially unchanged. Webb when considering criteria for presuming native status of vascular plants made a noticeable increase in range/numbers presumptive evidence for alien status but then he also regarded the lack of sexual reproduction in a similar light. The latter is clearly untrue of bryophytes and the former assumes that the environment in which species occur is essentially stable. Changing environmental and climatic factors can be correlated with the increase shown by some groups of species, *e.g.* epiphytes such as *Orthotrichum* spp., *Cryphaea*, various small Lejeuneoid hepatics, which from reproductive strategy and ecology we might expect to be rapid responders. While there are a few genuine examples of alien bryophyte introductions many more examples of native increasers, or natural colonists have, I believe, been too hastily considered alien.

Conversazione posters

Atherton, I (Hampshire). BBS Field Guide displays.

Porter, PR (University of Hertfordshire). Moss growth on a temperate glacier: Falljokull, Iceland.

Stieperaere, H (National Botanic Garden, Belgium) & Matcham, H (London). Three *Notothylas* species in Central Africa and Uganda.

Field excursion to Flitwick Moor, Bedfordshire, 10 September 2006

Alan Outen (Bedfordshire)

I have to confess that when I was asked to suggest some possible sites for the field meeting to follow the 2006 AGM I hoped very much that Flitwick Moor in Bedfordshire would be the chosen venue!

Flitwick Moor is a Site of Special Scientific Interest (SSSI) and a reserve of the Beds & Cambs Wildlife Trust, comprising 31 ha of acid mire, fen, open water, acidic and neutral grasslands, alder carr and oak/birch woodland. It is particularly important because the unusual flow of groundwater through the greensand under the reserve has produced a range of acidic and neutral habitats in a very small area. Peat was extracted until the mid-1950s and used mainly in purifying gas. Water from the Chalybeate springs rich in iron was once bottled and sold as a blood tonic. The pressures on the site from surrounding farmland and from water extraction by water companies are now further exacerbated by attempts to obtain planning permission to build housing on the adjacent field.

Its rich biodiversity means that this is without doubt one of the most important natural history sites in south-east England and has been long recognised as important for its bryophyte flora. James Saunders did much collecting here in the 1880s, and Tom Laflin and Peter Taylor in the late 1940s to early 1950s. The Cambridge Botany School with Harold Whitehouse made several excursions here in the 1960s and 70s and my own studies here began in 1970. With a bryophyte list of 113 species including ten species of Sphagna, Flitwick Moor has often been described as the richest bryological site in south-east England. (To put this in context Wicken Fen in Cambridgeshire has a total of 110 recorded bryophyte species but is eight times the size of Flitwick Moor).

Over twenty members of the Society from across Britain and from as far away as Belgium attended the field meeting. The visit proved to be exceedingly productive and has added greatly to the knowledge of this site and further emphasised its importance. No fewer than 83 different species were observed during the day but remarkably 22 of these were additions to the list for the site. Four species and one variety were also new for the County and one confirms an old record.

Many of the additions were of epiphytes reflecting their recovery across SE England.

Sphagnum palustre var. *palustre* is not uncommon here but Mark Hill also identified *Sphagnum palustre* var. *centrale,* otherwise currently known from one other site in Britain. Tom Blockeel added four species to the County list, these being *Eurhynchium speciosum, Ulota bruchii, Metzgeria fruticulosa* and *Cololejeunea minutissima*. He also found *Orthotrichum tenellum* (the first Bedfordshire record since 1892). Richard Fisk collected *Ulota phyllantha*, (a species with just one other known Bedfordshire site).

Other additions to the site list were *Bryum moravicum, Cryphaea heteromalla, Didymodon sinuosus, Eurhynchium striatum, Hylocomnium splendens, Hypnum resupinatum, Isothecium myosuroides (*found by Mark Lawley), *Orthotrichum affine* (found in at least 15 different places!), *O.lyelli, Polytrichum longisetum* (determined by Mark Hill), *Pseudotaxiphyllum elegans, Rhynchostegium confertum, R. riparioides, Chiloscyphus pallescens, Metzgeria furcata* and *Pellia endiviifolia.*

The overall list for the site therefore now stands at 109 mosses and 26 Hepatics, an overall total of 135 species. Forty-nine species of fungi were also recorded during the day of which four were additions to the site list.

My thanks to all those who contributed records making this such a successful event.

Summer Field Meeting in East Sutherland, July 1st-8th 2006

Mark Lawley

12A Castleview Terrace, Ludlow, Shropshire SY8 2NG

"They say that time
Heals a broken heart."
the old song goes,
"But time has stood still
Since we fell apart.
I can't stop loving you...."

Most English botanists feel this way about the Scottish Highlands, for absence and distance ever make the heart grow fonder. We yearn for the freedom of wild open spaces, and as car-bonnets pointed north at the beginning of July, our spirits rose with the barometer, in anticipation of adventures coming our way.

Nearly twenty bryologists descended on the coastal village of Golspie in East Sutherland (v.-c. 107), and disappeared into a variety of hotels, guest-houses, and self-catering accommodation. Along with unbroken fine weather throughout the week, this mixture of lodgings contributed in large measure to the pleasure of our holiday, for the advantages of roomy self-catering accommodation again became evident, just as they had two summers previously in North Aberdeenshire. Some members set up their microscopes in the drawing room in order to determine their gatherings comfortably and in companionable circumstances during the evenings after each day's excursions, while those of us less allured by the prospect of work sank into the lounge's soft settees with a cup of tea and planned the morrow's outings.

Our domestic arrangements also allowed flexibil-