

As part of a Heritage Lottery-funded nature project in North Yorkshire, **Matthew Adamson** has been recording the distribution of bryophytes on Studfold Farm in upper Nidderdale. In this article, Matthew reports some of the interesting observations from his investigation.

The Studfold Community Nature Project (SNCP) has a Heritage Lottery Grant to study the history and wildlife of Studfold, a farm in upper Nidderdale, North Yorkshire. It is a 3-year project investigating the interaction over the ages between the plants and wildlife on the site and the land use, which has included iron workings, lead mines and marble quarrying, as well as farming. Its 80 hectares are now mainly meadowland and pasture for sheep and cattle. The main geological feature is a fault along which flows Blayshaw Beck. To the north of this is a limestone inlier, while to the south is gritstone. Most of the limestone is overlain with boulder clay with Pennine gritstone boulders from which the walls around the fields have been constructed. Limestone is exposed along the gill, in some rocky outcrops in the fields and in two quarries on the site. In altitude the site ranges from 160 m at the confluence of Blayshaw Gill and the River Nidd to 300 m. The site is included in the 10x10-km

The Studfold Community Nature Project

square of SE07, which includes the whole of the headwaters of the Nidd up to Great Whernside (704 m), and it is in the tetrad that includes How Stean Gorge

Starting in 2007, the first year of the project concentrated on surveying and recording. We wanted to be able to depict the diversity contained within a fairly ordinary site that has no designation beyond being part of the Nidderdale AONB. We decided to record the bryophytes as one strand of the overall project because their fine adaptation to habitat and their susceptibility to environmental change mean that they reflect very closely the environmental history of the site.

We are using 50-m squares to make visible as much of the variety inherent in the site as possible. These squares are aligned to the UK grid, each centred on a grid reference 50 m apart. Recording is done monthly throughout the year with 294 squares having been surveyed to date.

Our only access to other records is through the NBN Gateway which has only 97 bryophyte



species recorded for the whole of SE07, the majority of these being those recorded by Tom Blockeel in How Stean Gorge on a visit in 1986. There are just a handful of other records. As far as we know, the rest of the region is unexplored and we have found no information regarding habitat, abundance or change. At the national level, all our species records equate to just one dot each in a 10x10-km square with no difference in status between a ubiquitous moss like *Kindbergia praelonga* which we have so far recorded from 221 squares and any of the bryophytes we have recorded from only one square and in many cases from one solitary colony. However, zoom into 50-m squares and a kaleidoscope of distributional patterns appears, illustrating the variety of ecological niches which can be seen when the records are plotted on a map.

212 species have been recorded so far and plotted on *MapMate*. The process of surveying has been as interesting as the results themselves. A hundred species were quickly recorded in a

△ The fields of Studfold Farm behind the village of Lofthouse in Upper Nidderdale with the wooded cleft of Blayshaw Beck. *Alan Croucher*

couple of visits, but each subsequent visit added a handful of new species with no apparent relationship with how obscure or hidden away they might be. For example, *Funaria hygrometrica* only appeared as the 200th species recorded, while in September 2008, the latest recorded species, *Barbilophozia atlantica*, was noticed for the first time – in full view on a boulder in the *Vaccinium–Deschampsia* heath. It then appeared to be growing on every boulder in sight! Other species were entirely predictable; after a while it even became rather therapeutic on a Sunday afternoon, poking around the bases of the gritstone walls and duly noting *Pseudotaxiphyllum elegans* and *Campylopus flexuosus* every 50 m. Being thrown onto our own resources meant heavy use of Smith (2004) and Paton (1999), and involved many hours of trying to persuade *Didymodon* leaves to sit

adaxial side up on the slide to check the costal cells, or trying to manoeuvre strongly recurved *Schistidium* leaves into position to observe the basal marginal cell walls. To avoid inadvertently giving entertainment to experts (Bosanquet *et al.*, 2005, p. 212) we have been extremely cautious and many a *Bryum* species languishes undetermined in a shoebox. Using as a rule of thumb, the rubric ‘if it possibly is, it probably isn’t’, we have had to leave unrecorded some less common species of *Scapania*, *Jungermannia*, *Lophozia* and *Cephalozia*, as we found it impossible to come to any definite conclusions about them.

Although the gritstone/limestone divide on the site gives it some geological diversity, the lack of any remotely scarce species does confirm the impression of Studfold as a rather degraded landscape with very few pristine corners left. We have very little to compare it with. Bosanquet *et al.* (2005) have recorded 241 species from the richest tetrad in Carmarthenshire in the upper Tywi valley, while according to Hill & Edwards (2003) the richest hectad in Dorset contains 272 species. Studfold itself covers only a fifth of a tetrad. It would be interesting to survey the whole tetrad. but it would be impossibly laborious and rather tedious given the amount of cow pasture it contains. In addition, we wouldn’t

have the advantage we have at Studfold of having the landowner’s permission to examine every square metre of ground. However, there are a fair number of species in How Stean Gorge and in the upper part of Blayshaw Beck in the same tetrad that we haven’t recorded from our site and with these the tetrad total must be quite close to that in Carmarthenshire. If we accept that Studfold is not an exceptional site, this shows how much county-wide surveying significantly under-records species diversity at the tetrad level.

294 fifty-metre squares have been surveyed (Table 1). Eight squares in the centre of the heavily fertilized fields have failed to produce a single bryophyte. A further 35 have only *K. praelonga* and *Brachythecium rutabulum*, and in fact 64% of the squares on the site yielded half a dozen or less species, such is the extent of the meadows and cow pastures.

At the other end of the scale, the two richest squares contain 109 species between them. It is interesting, though, that this richness is due to completely different factors. One square (65 species) holds perhaps the only habitat in Studfold which might contain original vegetation as Blayshaw Beck flows off the *Vaccinium–Deschampsia* heath and cuts through low cliffs into the wooded area, and the variety of species is due to the stability and quality of this habitat. The other square (68 spp.) consists of a number of different man-made microhabitats – walls, a lane, field edges and the footings of a water mill – as well as both the gritstone hanging wall and the limestone footwall of the fault through which the beck flows. As a result, only 24 species are common to both squares. Interestingly enough, only seven species on Studfold are exclusive to these two squares and they include *Pogonatum urnigerum* and *Sanionia uncinata* whose requirements are not exacting, yet for some reason have only one colony in the entire 80-hectare survey area.

Table 1. Species richness

Species per square	No. of squares
0–10	161
11–20	82
21–30	30
31–40	14
41–50	3
51+	4
Total	294

The total number of 212 species (Table 2) on the site is probably of little significance. It may be that this number is about the average for all intensively surveyed tetrads across the country. It is the species distribution within the site and the picture it gives of the landscape that is so interesting, and browsing through the maps generated by *MapMate* gives us a precise picture of the varied habitats of Studfold.

Table 2 shows that seven species have been recorded in over 100 squares, and these are

Table 2. Species frequency

No. of squares	No. of species
1–10	137
11–20	28
21–30	18
31–40	9
41–50	4
51–60	2
61–70	3
71–80	2
81–90	2
91–100	0
100+	7
Total	212

Table 3. Species recorded in over 100 squares

Species	No. of squares
<i>Kindbergia praelonga</i>	221
<i>Rhytidiadelphus squarrosus</i>	204
<i>Hypnum cupressiforme</i>	173
<i>Brachythecium rutabulum</i>	164
<i>Polytrichastrum formosum</i>	113
<i>Campylopus flexuosus</i>	108
<i>Pseudotaxiphyllum elegans</i>	105

detailed in Table 3. The substrate and shelter provided by the bases of the grit dry-stone walls forming all the field boundaries enable the last two species in the table to be so widespread.

On the other hand the poverty of much of the site as a whole is illustrated by the fact that 69% of the species have been recorded from 4% or fewer of the squares, while 45 species, or over 20%, have been recorded from only one square. However, some of the diversity of the site can be gauged from the fact that these species are scattered over 28 different squares. Only one square has a significant number of them and that is explained by its unique habitat: a damp shaded vertical cliff of an overgrown limestone quarry which is the only site for *Eucladium verticillatum*, *Fissidens osmundoides*, *Gymnostomum aeruginosum*, *Plagiomnium elatum* and *Jungermannia atrovirens* with *Scorpidium cossinii* in seepages on the floor below.

Earth recesses on banks in fields contain the single record for species like *Fossombronina pusilla*, *Dicranella schreberiana*, *Fissidens celticus*, *Pleuridium acuminatum* and *Pseudephemerum nitidum*. With such scattered and minute mosses it is very difficult to assess how completely they have been recorded, but suitable sites are in fact quite scarce with most bare earth among the grass sward created and kept completely barren by rabbit and sheep activity.

Other species are discussed under four main habitat headings.

Fields

The distribution of *Pleurozium schreberi* picks out the enclosed area of *Nardus–Agrostis–Festuca–Vaccinium* acid moorland. It is in exact complementary distribution with *K. praelonga* and *Brachythecium rutabulum*, which cannot survive in the heathy moorland but which are ubiquitous in the fertilized pastures and meadows.

Pseudoscleropodium purum grows in the interface between *Pleurozium schreberi* and *K. praelonga*. It is absent both from the extremely infertile moorland and the heavily fertilized parts of the farm fields, and picks out areas along the beck, the field boundaries and tracksides that have escaped excessive nitrogen enrichment.

Hylocomium splendens is even less tolerant of fertile sites, and its distribution identifies even more perfectly the steep banks and ridges of the fields over which tractors cannot manoeuvre.

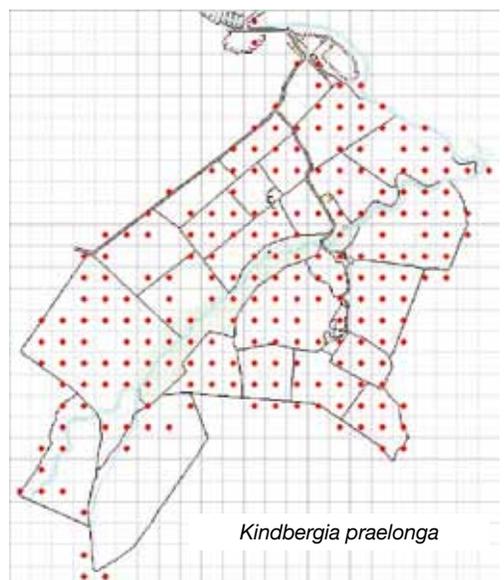
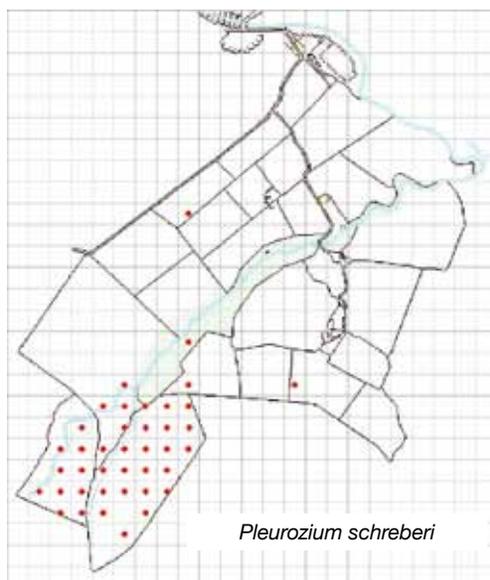
Walls

Grimmia trichophylla and *Dicranoweisia cirrata* pick out the gritstone walls, which are richest in the limestone area of the north and east of the site, those to the south and west being almost completely barren. *Grimmia pulvinata* and *Schistidium crassipilum* identify those walls incorporating limestone boulders. As an example of the heterogeneous nature of the walls, we have one colony of *Hedwigia stellata* in one of its few Yorkshire sites, sitting on top of a gritstone



△ *Hedwigia stellata* at its only site at Studfold, atop a gritstone wall. M. Adamson

▽ MapMate distribution maps of four of the field species discussed in the text. M. Adamson



wall completely surrounded by a sea of *Hypnum cupressiforme*, while below it on the south side of this wall is our only record for *Syntrichia montana* (= *S. intermedia*) growing with *Homalothecium sericeum*, *Bryum capillare*, *Schistidium crassipilum* and *Zygodon viridissimus*.

Epiphytes

The epiphyte flora is poor and the nature of the lichen flora indicates that air quality has been poor in the past. An unusual occurrence of the lichen *Usnea ceratina* on an old crab apple at the top of the site suggests fairly clean air nowadays, but *Zygodon viridissimus* and *Orthotrichum affine* are sparse and occur mainly on trees growing in squares with a rich variety of terrestrial bryophytes. The only record for *Ulota bruchii* is of a dozen tufts scattered on the upper side of one ash branch at a field edge with 50% cover of the lichen *Physcia adscendens*, suggesting a high nitrogen content. *Dicranum fuscescens* only grows on oak boles and not on rock faces as it does in profusion on another wooded site

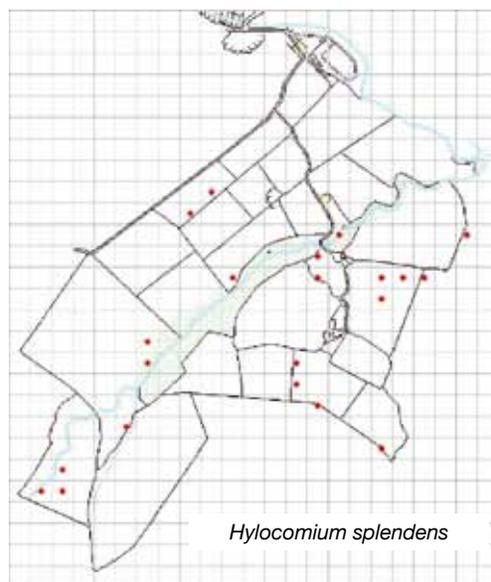
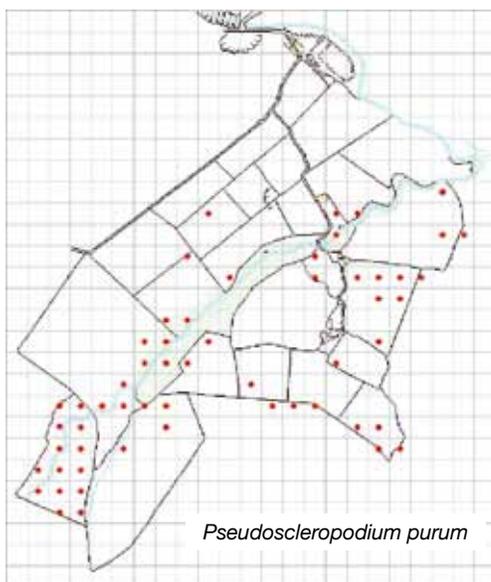
near Pateley Bridge, and *Leucodon sciuroides* only occurs on a massive limestone block used as a gatepost.

Blayshaw Beck

As Blayshaw Beck flows through the moors above Studfold it actually holds some characteristic bryophytes not found on the site. Slumped soil holds big populations of *Blasia pusilla* and *Discelium nudum*, and *Calliergon cordifolium* grows in flushes below mounds of *Climacium dendroides*.

As Studfold itself has been so thoroughly worked over by man, most of the bryophytes have colonized the area in place of species exterminated by habitat adjustment, and it is only along the beck that some of this original vegetation might remain.

Hygrohypnum ochraceum dominates the submerged gritstone slabs over which Blayshaw Beck flows into the survey area, while on the rock at the stream edge is an association typical of stream-sides all over the Nidderdale moors:





▷ Blayshaw Beck.
M. Adamson

H. ochraceum always at water level, then *Solenostoma sphaerocarpum* (= *Jungermannia sphaerocarpa*), *Scapania undulata* and *Pellia epiphylla*, with patches of *Dichodontium pellucidum* and *D. palustre*. In the side gill these plants are replaced by pure mats of *Nardia compressa*.

As the beck enters the shade of the woods, in the second richest square on the site, *Hygrohypnum ochraceum* gives way; *Scapania undulata* and *Marsupella emarginata* blanket the flat rock surface and *Hyocomium armoricum* becomes profuse on the vertical gritstone faces plunging into the water. There are some big old oak trees here and the flushed cliff below has tufts of *Blindia acuta* and cushions of *Amphidium mougeotii* with *Aneura pinguis*, *Riccardia multifida* and *Solenostoma hyalinum* (= *Jungermannia hyalina*), the last three at their only site.

This square also contains our only records for western mosses and liverworts on the edge of their distribution range in England: *Mylia taylorii*, *Bazzania trilobata* and *Polytrichum strictum*. Although *B. trilobata* is dotted about east of the Pennines, for example in a beck below Harlow Carr Gardens in Harrogate, it only turned up here after a diligent search, not in the woodland which has grown up on land heavily disturbed by lead mining, but on the heathy slope below the charcoal bloomeries of medieval ironworks! Nevertheless, the rich variety of *Cladonia* lichens and the presence of mosses like *Leucobryum glaucum* (our only record) point to the freedom from artificial inputs here.

The woodland itself is poor; for example it holds only two small colonies of *Rhytidiadelphus loreus* compared with the luxuriant swathes in Guisecliff above Pateley Bridge, but its association with oak fern on its only site suggests it might be a relic population.

The lead mine on the stream bank destroyed the original vegetation further down, and the flooding beck washed away any spoil. As a result there are none of the spoil heap specialists such as *Weissia controversa* var. *densifolia*, *Racomitrium lanuginosum* and *R. ericoides* that are such a feature of the spoil heaps along Ashfoldside Beck just to the south of Blayshaw Beck. Instead, vertical limestone under the larch trees holds Studfold's only colonies of *Rhynchostegiella tenella*, *Oxyrrhynchium pumilum* (= *Eurhynchium pumilum*) and *Lejeunea cavifolia*.

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