A Bryophyte Survey of a Hydro-power scheme at Crynant, Glamorgan

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Introduction

Rocky streams in areas of high relief are frequently associated with a high diversity of mosses and liverworts (bryophytes). Relatively few bryophyte species are found permanently submerged, but there is a characteristic assemblage of species associated with the intermittently submerged zone of the stream bed. Other bryophyte species depend on humid conditions, to which nearby streams may contribute. Within the intermittently inundated zone, there is typically a vertical zonation of species on rocks, developed in response to the duration and/or frequency of submergence. One of the effects of small scale hydro schemes is to decrease the duration of flood events, possibly modifying the zonation. However, no field experiments have been carried out.

A small hydro scheme has been in operation at Crynant for two years. Abstraction has been suspended while ecological surveys are undertaken.

Methods

The site is on the east side of the valley at Crynant, Glamorgan. The intake is situated just upstream of Coed-du farm (grid ref. SN 8018.0565). When in operation a sluice in a small dam is closed, to divert water into the intake. A residual flow is provided by a small pipe adjacent to the sluice (Figures 1, 2). Water leaving the turbine is not returned to the stream, but takes a different route to the floor of the valley. The stream is said to regularly become dry in summer, in part due to former mining disrupting the local hydrology.

The site was visited on 17 May 2012, from 10.30 to 16.30, in fine weather. The stream was walked from Main Road, Crynant (grid ref. SN 7931.0559) to the intake at Coed-du (grid ref. SN 8018.0565). The stream bed was surveyed, and also adjacent areas likely to be directly influenced by the stream, in practice up to approximately 2 m horizontally or vertically from the water. The flow at the time of survey was estimated by the developer as likely to be approximately equivalent to an exceedance of Q50.

All species of bryophytes encountered were recorded. Most identification was carried out in the field, but a number of specimens were collected for microscopic examination. Nomenclature follows Hill *et al*. (2008).

Results and discussion

A total of 62 bryophytes were recorded during the survey (Table 1).

The quality of the stream in terms of bryophyte habitat increases as one ascends the valley side. At the bottom of the area surveyed, the stream is culverted, running between brick and concrete walls. Bryophytes here comprise mainly species which are common in disturbed habitats, including *Amblystegium serpens*, *Barbula convoluta*, *Bryoerythrophyllum recurvirostrum*, *Bryum capillare*, *Didymodon rigidulus*, and *Schistidium crassipilum*. A little further upstream the stream bank is in a more natural state, with soil banks, drystone walls and cobbles, but habitat and bryophyte diversity is still low, and the stream runs between houses and new developments. Shortly below the old railway bridge the stream has tree-lined stable banks which have a good bryophyte cover.

The best part of the stream is the wooded section from immediately above Gould Farm at grid ref. 7968.0553 up to the stream crossing below Coed-du, at 8005.0558 (Figures 3, 4). This section is an attractive wooded valley with abundant ferns and mosses. The stream bed comprises bedrock and boulders and there is at least one substantial waterfall (Figures 7, 8, 9).

In this area, the bryophyte flora is well-developed and has a natural aspect. Within the area of stream-bank which is intermittently inundated by the natural flow regime, there is a zonation of species ((Figure 10). At the lowest level, wet or in part submerged at the time of survey, are *Chiloscyphus polyanthos* (abundant), *Rhynchostegium riparioides* (abundant), and *Scapania undulata* (locally abundant). On less frequently submerged rock are species including *Brachythecium rivulare*, *Heterocladium heteropterum*, *Hyocomium armoricum*, *Racomitrium aciculare*, and *Thamnobryum alopecurum*. The moss *Brachythecium plumosum* is frequent, and here marks the approximate upper limit of the typically freshwater species.

At a waterfall at grid ref. 7977.0551, at the time of survey splash from the falls created a wet zone at least 2 m each side of the falls, with *Chiloscyphus polyanthos*, *Dichodontium pellucidum*, *Fissidens taxifolius*, *Rhynchostegium riparioides* and others (Fig. 7).

A sandstone cliff which has been quarried in the past, extending from the stream along the slope, provided microhabitats for a few species not found elsewhere, including *Diphyscium foliosum* and *Rhadoweisia crispata*.

In some places the steep banks beside the stream are damp from seepage; here *Hyocomium armoricum* forms conspicuous golden-green mats, sometimes with *Sphagnum denticulatum*. *Fissidens curnovii* occurred on a seeping bank where the steep slope prevented competition from larger species such as *Hyocomium*.

No nationally scarce (Wales or Britain) species were found at the site. Two species are uncommon in Glamorgan (Perry 1994, Hill *et al*. (1992): *Fissidens curnovii* and *Rhabdoweisia crispata*, for which Perry (1994) mentions two localities each. These two species are here near the eastern edge of their main range in Wales. Neither is likely to be directly affected by abstraction; *F. curnovii* occurs on a seeping bank fed mainly by groundwater, and *R. crispata* occurs on a rock face above the flood level of the stream. *R. crispata* in general prefers sheltered and humid conditions. The role, if any, of stream flows in maintaining humidity nearby is unknown.

The likely effects of abstraction on the bryophyte flora are hard to predict. In general, it might be predicted that the lower parts of the bryophyte zonation would move downwards in response to a reduced duration of submergence, but the magnitude of such a move might be small. The uppermost parts of the zonation, for instance those occupied by the moss *Brachythecium plumosum*, may be largely unaffected, as the highest flows will be little affected by abstraction.

References

Perry AR. (1994). Hornworts, liverworts and mosses of Glamorgan. Chapter 8 in Wade AE, Kay QON, Ellis RG (eds), *Flora of Glamorgan*. London: HMSO.

Hill MO, Preston CD, Smith AJE. 1992. Atlas of the bryophytes of Britain and Ireland. Volume 2 . Mosses (except Diplolepideae). Colchester: Harley Books.

Hill MO, Blackstock TH, Long DG, Rothero GP. 2008. A checklist and census catalogue of British and Irish bryophytes (updated, 2008). British Bryological Society.

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TABLE 1. Bryophytes recorded during the survey.

Species	Notes
Amblystegium serpens	on concrete, rocks and tree bases, frequent in lower part of site.
Anomodon viticulosus	on drystone wall, rare.
Atrichum undulatum	on soil banks.
Barbula convoluta	walls and soil in lower parts of site.
Brachythecium plumosum	on rocks in upper part of inundation zone, throughout site but locally abundant in woodland.
Brachythecium rivulare	on damp rocks beside stream, occasional.
Brachythecium rutabulum	on drier rocks and tree bases.
Bryoerythrophyllum recurvirostrum	on breeze-block wall at lower end of site.
Bryum capillare	walls beside culvert.
Bryum sp.	crevice in wall at bottom of site; unidentifiable without capsules.
Calypogeia arguta	on eroding soil banks, occasional.
Cephalozia bicuspidata	on soil bank.
Chiloscyphus polyanthos	on wet stones and rocks in the stream channel and in a flush, locally abundant in upper part of site.
Cratoneuron filicinum	on the ground in a stony flush beside stream in woodland.
Dichodontium pellucidum	on splashed or occasionally inundated rocks by stream, rare.
Dicranella heteromalla	soil banks, rare.
Didymodon fallax	on soil and on walls in lower part of site.
Didymodon insulanus	on rock in woodland, occasionally inundated, rare.
Didymodon rigidulus	on breeze-block wall at lower end of site.
Diphyscium foliosum	moist crevice on rock face, rare.
Diplophyllum albicans	on rocks and soil, occasional.
Encalypta streptocarpa	small quantities on walls at bottom end of site.
Eurhynchium hians	on soil and brickwork, occasional.
Eurhynchium praelongum	rocks, soil and tree bases, frequent.
Fissidens curnovii	on seeping rocky bank by stream in woodland, grid ref. 7975.0553. Apparently rare in Glamorgan, only two sites mentioned by Perry (1994).
Fissidens bryoides	on soil banks.
Fissidens dubius	on cliff in woodland.
Fissidens taxifolius var. taxifolius	on soil banks, and on wet rocks in splash zone of waterfall.
Frullania dilatata	on ash trunk.
Heterocladium heteropterum	on rocks, including those occasionally inundated, occasional in upper part of site.
Homalothecium sericeum	concrete sides of culvert at lower end of site.
Hyocomium armoricum	damp rocks and soil, throughout site, but most abundant in woodland, locally forming large colonies on seeping banks.
Hypnum andoi	on tree base.
Isothecium myosuroides	on rocks and tree bases, occasional.
Lejeunea lamacerina	on steep rocks near stream, occasional in woodland.
Lepidozia reptans	on an oak log.
Lophocolea bidentata	on base of ash trunk.
Marsupella emarginata	wet rock face, rare.
Metzgeria furcata	on rocks and tree bases, occasional.
Mnium hornum	on soil banks in woodland, occasional.
Nowellia curvifolia	on two oak logs in woodland.
Orthotrichum stramineum	on dead twigs over stream.

Orthotrichum tenellum	on dead twigs over stream.
Pellia epiphylla	soil banks, frequent.
Plagiomnium undulatum	on wet soil banks.
Plagiothecium succulentum	stable soil banks and rock ledges, occasional in upper half of site.
Pogonatum aloides	soil banks, rare.
Pohlia melanodon	on a soil bank.
Polytrichum commune	on wet seeping bank in upper part of site.
Polytrichum formosum	on soil, locally frequent in woodland.
Pseudotaxiphyllum elegans	on soil banks in woodland, occasional.
Racomitrium aciculare	on occasionally inundated rocks, occasional, rarely well-developed.
Rhabdoweisia crispata	moist crevice on rock face, rare. Rare in Glamorgan, only two sites mentioned by Perry (1994).
Rhizomnium punctatum	wet rocks and soil, occasional in woodland.
Rhynchostegium confertum	on tree root, lower part of site.
Rhynchostegium riparioides	on wet rocks in stream channel or where splashed, throughout site, abundant in woodland areas.
Scapania undulata	on wet rocks, or submerged, frequent in upper part of site.
Schistidium crassipilum	concrete sides of culvert.
Sphagnum denticulatum	on wet seeping banks, seen twice in upper part of site.
Thamnobryum alopecurum	on rocks by water, occasionally inundated, occasional in woodland.
Tortula muralis	walls beside culvert.
Ulota bruchii	on dead twigs over stream.

Figure 1. Flow at the intake at time of survey (photograph taken at. approx. 16.00).

Figure 2. Proposed residual flow, demonstrated at the intake by closing the sluice briefly (photograph taken at approx. 10.30).

Figure 3. Culvert at bottom of site (grid ref. 7931.0559), with mosses on concrete and brick walls.

Figure 4. Small weir near bottom of site; growth of the freshwater moss *Rhynchostegium riparioides* on the brick wall demonstrates the extent of flow and splash at high flows.

Figure 5. The stream in woodland above Gould Farm.

Figure 6. Seeping banks beside stream, with mats of *Hyocomium armoricum* (bottom left); *Fissidens curnovii* grows on the vertical bank to right of centre (grid ref. 7975.0553).

Figure 7. The falls in woodland at 7977.0551, with wet rock surfaces in the splash zone.

Figure 8. Rock in right foreground with freshwater species including *Hyocomium armoricum, Scapania undulata* and others, despite being dry at time of survey. Rock face on right has *Rhabdoweisia crispata*.

Figure 9. The stream in woodland; darker rocks on falls are covered by *Rhynchostegium riparioides*, brighter moss to right of centre is mainly *Hyocomium armoricum*; the liverwort *Scapania undulata* occurs close to the water below the falls.

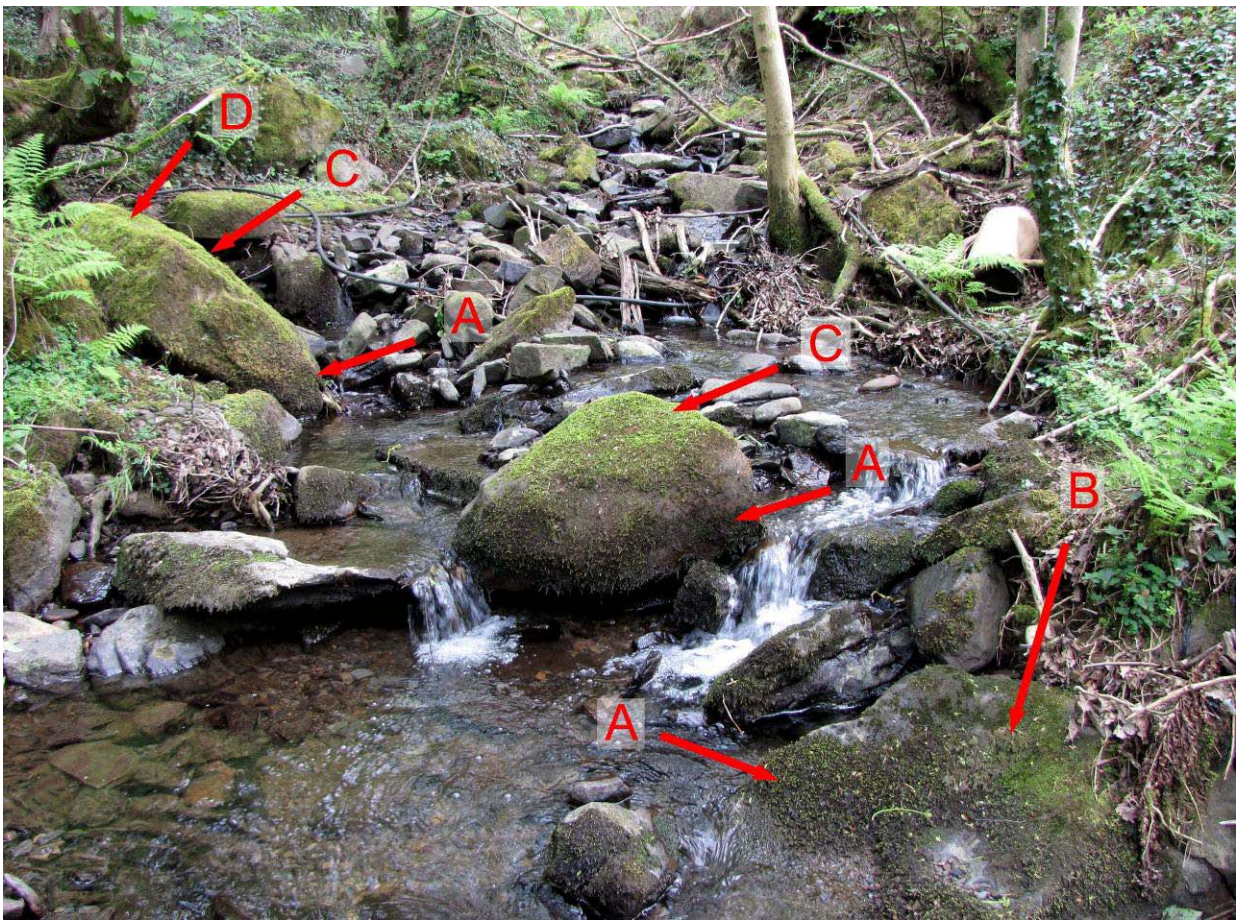

Figure 10. Zonation on streamside rocks. A: zone with *Rhynchostegium riparioides*; B: rock with *Heterocladium heteropterum*, *Racomitrium aciculare*, *Thamnobryum alopecurum*; C: *Brachythecium plumosum*; D: top of boulder with *Eurhynchium praelongum*. Locations A-C represent typically freshwater species, Location D represents the lower limit of non-freshwater species.