Proc. Isle of Wight Nat. Hist. Archaeol. Soc. ***39****, 47-52 (pub 2025)*

SOFT CLIFFS: BIODIVERSITY AND CLIMATE CHANGE

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Abstract : *Residents of the Isle of Wight have been made acutely aware of our eroding coastline in recent years as a number of catastrophic landslides and cliff collapses have impacted greatly on property, infrastructure, footpaths and roads. The Bonchurch Landslip (2023) was particularly catastrophic and there have been other smaller landslides and collapses around Ventnor.*

Is the current rate of land movement having an impact on biodiversity? It is too early to say, but some examples given here suggest that some species are being adversely affected. However, the species provided as examples here are frequently small, unobtrusive and difficult to identify, and longer-term studies would be needed to have confidence in these trends.

Keywords: Coastal erosion, Glanville Fritillary, invertebrates, bryophytes, lichens, Isle of Wight

Introduction

The Isle of Wight coastline has always been affected by a range of natural hazards including coastal erosion and cliff retreat, coastal landsliding and sea flooding. Our first president, George Colenutt gave his final lecture to the Society, 'Fifty years of Island coastal erosion' illustrated by lantern slides, 87 years ago (Colenutt, 1938). The rates of erosion and the risk of flooding from the sea are expected to increase over the coming century due to the impacts of climate change, including increasing storminess, increasing winter rainfall and rising sea levels. Coastal erosion is not always gradual and can occur through dramatic events such as landslides and cliff falls, where many metres of land may be lost in a single event. The landslide complex around Ventnor is particularly sensitive to future climate change. Landslides are triggered by the combination of increased toe erosion at the base of the cliff and increased winter rainfall promoting higher pore water pressures within the landslide.

The eroding southern coastline of the Island has long been recognised as important for biodiversity. It is a challenging environment for plants and animals. Exposure to gale force winds and salt spray, steep slopes with thin soils and frequent erosion and landslides, all shape unique and characteristic wildlife habitats. Nevertheless, these habitats are home to many nationally rare plant and animal species, quite often more southerly or Mediterranean species that have a toe-hold here on the south coast of England.

Biodiversity significance

From a biodiversity perspective, the soft cliffs and slopes are recognised as being one of the few habitats in the UK where pioneer communities of invertebrates have been able to survive without disruption by man. The southern coastline, subject to rapid erosion, has given rise to one of the finest series of soft cliffs, locally punctuated by steep ravines or chines, to be found along the British coastline, second only to the west Dorset coastline.

The importance of coastal soft cliffs for invertebrates hinges on their capacity to provide a historical continuity of micro-habitats rarely found with predictability elsewhere. Their unstable nature constantly creates bare ground and suppresses ecological succession. Bare ground is a key soft cliff habitat which offers nesting sites for burrowing bees and wasps, hunting grounds for visual predators such as ground beetles and the Cliff Tiger beetle *Cylindera germanica*, warm basking areas allowing thermophilic (warmth-loving) species to remain active in cooler conditions, and germination sites for wildflowers. Where cliffs are colonised by plants, pioneer plant communities provide valuable nectar and pollen sources for bees and other insects. The plants are also the food plants of phytophagous insects (such as the weevil *Baris analis*) and their predators, including many of the solitary wasps that nest on soft cliffs.

Gently slumping cliffs, with transient pools colonised by reeds and wet flushes provide a variety of habitats and ecological niches. These areas can accommodate invertebrates with aquatic stages in their life cycle including water beetles, craneflies and soldierflies; and provide food plants and refuge for insects with specific associations with aquatic plants. Seepages and pools provide wet muds that are required by many species of bees and wasps for nest construction. On most soft cliff sites there are a range of these micro-habitats, plus others such as calcareous grassland and scrub (Fig.1). Habitat variation on a very small spatial scale can produce an incredibly complex environment in terms of temperature, exposure, vegetation type and structure, and stability. It is the juxtaposition of a range of micro-habitats that

Fig. 1: The combination of pools, bare ground and scattered vegetation makes Atherfield Ledge a good site for invertebrates provided that slippages are not too frequent. Coltsfoot, shown in this picture, provides an early nectar source for insects. March 2016.

Fig. 2: Compton Bay March 2021.

Fig. 3: Redcliff March 2024.

Regular repeated slippages of soft cliffs have resulted in the loss of the prime breeding habitat of Glanville Fritillaries.

makes a site important. Invertebrate species often rely upon a range of habitat features to complete their life-cycles. For example, burrowing bees require friable materials in which to excavate nests but also depend upon nectar and pollen sources in close proximity. Sites which provide a range of micro-habitats on a small spatial scale are able to support a great range of species.

A survey of invertebrate life by Buglife in 2006 (Whitehouse, 2007) reached the conclusion that the Island's maritime cliffs and slopes support impressive overall totals of important invertebrate species, although to a lesser degree than the extensive West Dorset soft cliffs. One of the most important groups of insects on the Island's coast are the bees and wasps (Hymenoptera). Included in this group are nationally rare species such as the Large Mason Bee *Osmia xanthomelana* (although this species is now thought to be extinct on the Island), the mining bee *Lasioglossum angusticeps*, the Potter Flower Bee *Anthophora retusa*, the digger wasp *Mimumesa atratina*, the Black-headed Mason Wasp *Odynerus melanocephalus* and the Nomad Bee *Nomada conjugens*.

The beetle fauna of the cliffs is nationally important and includes such species as the Cliff Tiger beetle *Cylindera germanica*, the ground beetle *Drypta dentata*, the rove beetle *Bledius crassicollis*, Chestnut Click beetle *Anostirus castaneus*, and the weevils *Baris analis*, *Mononychus punctumalbum* and *Cathormiocerus cocius*. The butterfly and moth fauna are also very rich and includes several important moths including Beautiful Gothic *Leucochlaena oditis*; the micro-moth *Grapholita gemmiferana*; and *Metzneria littorella* a micro-moth feeding on seeds of Buck's-horn Plantain.

Many of these are thermophilic species. They may also have complex habitat requirements. Additionally, and importantly, they are often inconspicuous species which can only be recognised reliably by experts and, as such, it is difficult to assess how they are responding to increased erosion.

Glanville Fritillary

The 'flagship' species of our soft cliffs, the Glanville Fritillary butterfly *Melitaea cinxia*, is a species not found naturally elsewhere in Britain and is easily recognised both in the adult and larval stages (Figs 4, 5 & 6).It has been the subject of a remarkably long-

Fig. 4: An adult Glanville Fritillary. Photo Andy Butler

Fig. 5: Glanville Fritillary larvae in March.

Fig. 6: Glanville Fritillary larval webs. In the picture, the larvae have vacated the web to the right and moved to a fresh web.

running monitoring programme by members of the Isle of Wight Natural History and Archaeological Society. The Glanville Fritillary is found in colonies along much of the southwest coastline and eastwards to Bonchurch. There is also a population centred around Redcliff, Sandown. The annual monitoring of spring larval webs has taken place every year since 1983! A few of the original surveyors are still taking part!

The information gathered has given us a good overall picture of how the butterfly is faring (Butler, 2008). Essentially, the size of the population can vary considerably from one year to the next. Periods of abundance are generally followed by population crashes, but the species has a great ability to recover.

Although the larval foodplant of this species, Ribwort Plantain (*Plantago lanceolata*), is widespread, the butterfly is confined to areas of short grassland on soft cliff slopes. Early bioclimatic modelling attempts by biologists to predict how species would respond to a warming climate suggested that the Glanville Fritillary would be one of the first species to expand their range northwards from the south coast of the Island into southern England and to produce two broods per season, as they do on the Continent. To date, this has not occurred. However, larval monitoring is demonstrating that more subtle changes in their behaviour are beginning to be seen.

The Glanville Fritillary exists as a series of metapopulations. If it is lost from one site, recolonisation will occur from nearby sites. In recent years, in many places the soft cliffs have become treacherous to visit early in the season making it difficult to assess populations accurately. Recently slipped cliffs are bare of vegetation and if slumping recurs before a vegetation community can begin to colonise, as has often been happening, there are no or few suitable niches for the butterflies to lay their eggs.

In good years, the population expands and both butterflies and larval webs can be found in sites which have been considered to be marginal. These are in open areas on the gravel capping of the downs, on south facing chalk grassland and greensand ridges. Surveys in very recent years (Paul Davies, pers. comm.) have demonstrated that these sites, inland from the southwest coastline, now hold substantial, and probably increasing, populations whilst the populations at some coastal sites have shown a medium-term decline. They appear to have been lost from one or two coastal sites.

It would be wrong to conclude that the populations are moving inland with the advent of increased coastal erosion but coastal populations in some sites may be difficult to sustain; whilst some inland sites are currently able to maintain viable populations that may not have been the case in the past.

Plant communities on Redcliff

The unstable nature of soft cliffs and slopes, constantly creating bare ground and suppressing ecological succession has also been important for the survival of some flowering plants and communities of bryophytes which are otherwise rare nationally. The moss Oval-leaved Pottia, *Pterygoneurum ovatum,* was once common in Victorian times on mud-capped stone walls but is now found on open calcareous ground (Porley & Hodgetts, 2005). It has declined markedly in the 20th century and is now rare and declining.

On the Island, *Pterygoneurum ovatum* is a component of a specialised bryophyte community confined to maritime-influenced cliff-top thin calcareous grassland at Redcliff (Fig. 7).

Fig. 7: The bryophyte community at Redcliff showing a clump of *Pterygoneurum ovatum* at the centre of the picture surrounded by tiny triangular green shoots of *Acaulon triquetrum*. December 2018 Photo George Greiff

The habitat was very interesting. It was growing close to the cliff edge on a thin band of Lower Chalk in open ground disturbed by rabbit burrowing (Fig. 8).

Fig. 8: The specialised bryophyte and flowering plant community at Redcliff is confined to the narrow rabbit disturbed break of slope showing bright green in this photograph taken in December but bare of vegetation in the summer.

This community primarily comprises small to tiny mosses that grow through the winter and die in the spring. They are impossible to find from late spring to autumn when their sites are frequently parched and sun-baked. *P. ovatum* was recorded at Culver in 1909 on an Isle of Wight visit by Henry Herbert Knight, a former president of the British Bryological Society. It was not found here again until December

2018 when George Greiff rediscovered it. Associated species included the tiny ephemeral Triangular Pygmy-moss, *Acaulon triquetrum*, an even rarer moss listed on Schedule 8 of the Wildlife & Countryside Act 1981 and legally protected under Section 13. It is known from just a tiny handful of sites on the south coast of the Island and Dorset. Both these species enjoy semi-arid conditions and are much more frequent in the Mediterranean region.

Interestingly, the very restricted site at Redcliff is also home to a nationally scarce flowering plant, Hairy-fruited Cornsalad, *Valerianella eriocarpa,* another plant which behaves as a winter annual, germinating and growing during the winter, flowering in the spring and then dying down (Fig. 9).

Fig. 9: Hairy-fruited Cornsalad, *Valerianella eriocarpa*.

Valerianella eriocarpa was at one time considered to be an uncommon weed of arable sites but further studies in the early twenty first century (Pearman & Edwards, 2002) considered it to be native on thin, drought-prone calcareous soils in coastal areas of Dorset and the Isle of Wight. At the Redcliff site, the plant grows with Dwarf Spurge, *Euphorbia exigua*, a nationally vulnerable plant of arable land which has found similar conditions at Redcliff, probably a native site where it behaves as a winter annual.

When George Greiff and John Norton visited the Redcliff site early in the year in 2024, they were unable to find any sign of the specialised bryophytes and they considered that the very restricted site they occupied had been lost to erosion (G. Greiff, pers. comm.). The author visited the site with Nick Aston on 27th April 2024 to assess the population of *Valerianella eriocarpa* and, after much searching, located a single flowering plant. I considered that at least part of the site could have been lost to erosion.

This may be another example of biodiversity loss as a result of an increased erosion rate of coastal cliffs. However, it is too soon to be confident if this is the case. Each of these specialised plants show populations which fluctuate considerably from year to year. In a good year, the population of *Valerianella eriocarpa* at this site exceeds 600 plants. Each of these species requires soil disturbance to create the open ground they require and, provided a few propagules persist, they can rapidly increase their population if conditions are right. On the other hand, the very restricted area they occupy may have been permanently lost to erosion.

The Undercliff

St Catherine's

Most cliffs form at the junction of land and sea, where groundwater-driven land slippage and/or erosion by the sea have created a break in slope, but on the Island, there is also an extensive landslip zone. The Undercliff landslide complex is a wide slumped skirt of land (stretching for nearly 10 km along the coast) from Luccombe in the east to Blackgang in the west. It is sheltered to the north by an inner cliff rising to 140m above sea level. It was activated as a consequence of aggressive coastal erosion following a rise in sea levels after the last Ice Age, about 10,000 years ago. The south facing, sheltered Undercliff has a warm, humid environment, which has given rise to its own distinctive flora. Historically, this would have been a largely open, grazed landscape interspersed with tumbled rocks and wooded pockets. It was an outpost for some plants with a more Atlantic distribution, in particular bryophytes. The open undercliff landscape has survived best in the area around St Catherine's Point and slumps and slippages still occur here, creating open ground habitat. The soils are complex, being a jumble of calcareous chalky soils and more acidic greensand and chert. Springs emerging from the inner cliff are a cause of slumping and give rise to ecologically interesting habitats.

Just west of Windy Gap carpark the seepages are habitat for one of Britain's rarest leafy liverworts known as Blackwort (*Southbya nigrella)* (Fig. 10).

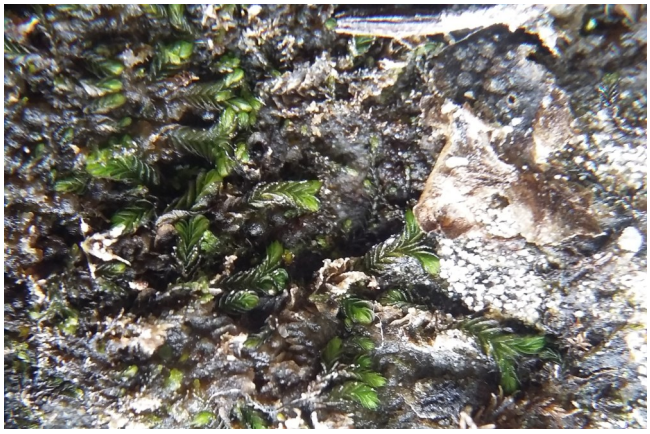

Fig. 10: Blackwort, *Southbya nigrella,* at St Catherine's Point. April 2017 Photo: George Greiff

It is critically endangered in England, although widespread in the Mediterranean. In this country, it is only known from about twenty sites on Portland Bill in Dorset and the small population at St Catherine's. I was first shown the plant by Francis Rose, Ted Wallace and Rod Stearn in 1983. At the time, there was an easy footpath from the Windy Gap carpark to Blackgang, and *Southbya nigrella* was readily found on shaded calcareous rocks by a stream that crossed the footpath. Also in the

vicinity was another very rare small calcicolous leafy liverwort, *Cephaloziella baumgartneri,* a species known only from a few sites on the southern coast of England.

By 1992, the site was becoming overgrown, principally by invasive Buddleja. In 2001, a period of heavy rainfall reactivated the landslide complex, resulting in a major landslide around the area occupied by the rare bryophytes. The footpath was closed and access to the site became quite difficult. When a group of bryologists together with National Trust and Natural England staff visited the site in May 2017, only a very few plants of *Southbya nigrella* were located and the site had become heavily overgrown and shaded by scrub. Sharon Pilkington visited the area in 2024 and discovered a small area of *Southbya*, together with *Cephaloziella baumgartneri* in more open slumped ground below the original site (Mark Larter, pers. comm.) (Fig. 11).

Fig. 11: Slumping ground with seepages provides the ideal habitat for *Southbya nigrella* and *Cephaloziella baumgartneri* at St Catherine's.

Landslips are vital to ensure the survival of these very rare extreme southern bryophytes, which require calcareous sandstone boulders brought downslope by undercliff slumps and washed by seepages. The area in which they occur is extremely localised and threatened not only by the frequency of landslides but also by invasive scrub.

Bonchurch Landslip

Bonchurch Landslip is a Site of Special Scientific Interest and one of its listed features is as an outpost for a suite of shade-tolerant western bryophytes including the Starry Thyme-moss, *Mnium stellare* (Fig. 12), and the leafy liverworts Rossetti's Pouncewort, *Cololejeunea rossettiana* and MacKay's Pouncewort, *Marchesinia mackaii* (Figs. 13 & 14). Bonchurch Landslip also has an interesting lichen flora including the rare western old woodland lichen *Scytinium* (*Leptogium*) *lichenoides* (Fig. 15). The wooded landslip provides a sufficiently humid environment to support several species which principally have a western distribution in Britain.

The ecological quality of the area has deteriorated in recent years as Atlantic Ivy (*Hedera hibernica*) has grown unchecked, smothering the rocks and trees where these specialised species occurred. This is a more general feature of woodlands and has been

Fig. 12: *Mnium stellare* in Bonchurch Landslip in 2008.

Fig. 13: *Marchesinia mackaii* at Bonchurch Landslip in 2008.

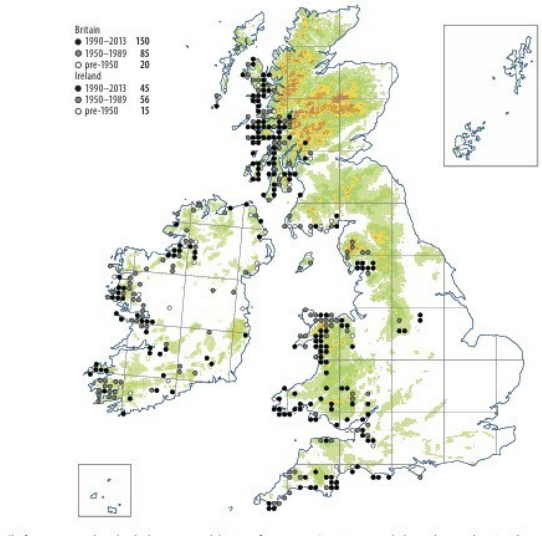

Fig. 14: This distribution map of *Marchesinia mackaii* shows how Bonchurch Landslip is an outlier of this predominantly western species and is typical of a number of western bryophytes and lichens occurring in Landslip. British Bryological Society.

considered to be a result of lack of woodland management and milder winters.

Nevertheless, surveys by George Greiff in more recent years have demonstrated that the specialised bryophytes have persisted, albeit extremely locally and in reduced quantity. Also, I have found a fertile population of *Scytinium lichenoides* surviving in one site together with some of the more interesting crustose lichens on old Hazel in the vicinity.

Fig. 15: The lichen *Scytinum* (*Leptogium*) *lichenoides* in Bonchurch Landslip in 2008, now lost in the landslip. Bonchurch Landslip was its sole Island locality.

The catastrophic landslide in 2023 has completely destroyed most of the areas where these specialised lower plants occurred (Fig. 16).

Fig. 16: Aerial view of Bonchurch Landslip taken in 2024. Photo: Mike Collins

The lichen-rich site has been completely buried. Many greensand boulders have become exposed, and these could provide suitable niches for the bryophytes to recolonise. However, it is more likely that the open area will be colonised by Ivy and tree regeneration, destroying this opportunity.

Ironically, the best surviving population of the leafy liverwort *Cololejeunea rossettiana* was not on rocky outcrops but along the north-facing wall at the top of the cliff leading to the Devil's Chimney. This area has survived the slippage, but the site is likely to be lost again by aggressive ivy colonisation (G. Greiff, pers. comm.) Small scale landslips are probably useful in creating new opportunities to recolonisation by lower plants, but the scale of the recent landslide makes this unlikely.

Conclusions

Evidence suggests that at least some of the rare and specialised soft cliff species are being adversely affected by the current rapid rates of coastal erosion. The Glanville Fritillary seems to be able to successfully colonise suitable micro-habitats inland from the coast. It may be that some of the other specialised invertebrates are able to do the same but for many of them this seems unlikely as their preferred habitats are unlikely to be duplicated inland.

Similarly, the bryophytes are rare because the specialised conditions they require are not replicated inland. Without specialised monitoring, the disappearance of some of these species could happen before we become aware.

Acknowledgement

I am grateful to George Greiff for helpful comments on this paper. Photographs by the author unless otherwise stated.

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