Ymddiriedolaeth Natur
Maldwyn
Montgomeryshire
Wildlife Trust

Pearl-bordered Fritillary (*Boloria euphrosyne*) Seminar Report

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Executive summary

The seminar brought together conservation practitioners, researchers, volunteers, land managers, environmental NGOs and statutory bodies to compare experiences of conserving the Pearl-bordered Fritillary (*Boloria euphrosyne*) across Wales, England and Scotland.

Attendees: Alison Alexander (Montgomeryshire Wildlife Trust), Bethan Beech (Natural Resources Wales), Ben Mullen (Powys County Council), Clive Faulkner (MWT), Dave Wainwright (NRW), Michael Howe (NRW), Dr Jenny Joy (ex Butterfly Conservation), Jenny Plackett (BC South West), John Tilt (BC Grafton Wood), Jeremey Joseph-Meade (NRW), Lowri Geddes (MWT), Marian Newell (BC West Midlands Volunteer), Martin Warren (ex BC), Matthew Oates (ex National Trust), Mike Slater (BC Worcestershire), Mike Williams (W Midlands Butterfly and Moth Society), Natalie Norton (Shropshire Wildlife Trust), Nicholas Cain (SWT), Paul Dunn (BC Volunteer), Rhona Goddard (ex BC), Richard Bluck (Wild Cymru), Richard Smith (BC South Wales Volunteer), Dr Simon Spencer (ex MWT), Steven Lofting (BC), Tammy Stretton (MWT), Tim Ward (MWT Trustee/ Volunteer), Kate Wollen (Forestry England), Dr Zoe Randle (BC)

Presentations described the species' persistence in a variety of very different settings—from bracken slopes and commons to coppice, woodland rides and upland forest edges— and its dependance on warm, sheltered mosaics containing violets, a thin litter layer, structural variation and continuing disturbance. Key themes:

- Effective management is essential: unmanaged sites progress towards dense bracken, bramble, scrub and woodland and rapidly lose suitable breeding habitat.
- Monitoring confirms broad patterns but often lacks the resolution needed to link specific interventions to changes in habitat quality or butterfly abundance.
- Long-term recovery will require connected landscapes, sustainable grazing or effective substitutes, consistent monitoring, research into climate and ecological interactions, and durable collaboration with landowners and volunteers.

The seminar's strongest collective message was that no single intervention is sufficient. Successful conservation combines rotational habitat management, observation of breeding conditions, long-term site stewardship and exchange of evidence across regions.

Priority Action

Establish a shared national framework for rapid habitat assessment, supported by periodic detailed surveys and consistent recording of management interventions.

Presentations

Seminar purpose and context

Dr Simon Spencer

The seminar was convened to compare the history, current condition and conservation challenges of Pearl-bordered Fritillary populations, with particular attention to practical site management, violet ecology, monitoring design, landscape connectivity and the underlying causes of decline.

The opening discussion described a formerly widespread butterfly now concentrated in fragmented populations. Remaining sites are frequently isolated within unsuitable surrounding land, leaving small colonies vulnerable to extreme weather, fire, habitat succession and genetic effects. Metapopulations - a connected network of occupied and potentially suitable sites - are the most resilient conservation model.

PBFs in Montgomeryshire 2002-2026

MWT Conservation Officer Tammy Stretton and MWT Trustee and Volunteer Tim Ward

Tammy Stretton reviewed the status and management of the six remaining Montgomeryshire Pearl-bordered Fritillary sites. Management focuses on maintaining violet-rich habitat (*Viola riviniana*) through rotational winter cutting of bracken (P*teridium aquilinum*) and scrub using tractors, Robocut and brush cutters, alongside coppicing, pollarding, pruning and bracken raking by volunteers. Trials of summer bracken rolling and harrowing have also been undertaken. Site management varies according to habitat and ownership, but the lack of appropriate grazing remains a common challenge, making repeated mechanical intervention essential. The species is now restricted to the Welshpool metapopulation and Middletown Hill. Three Montgomeryshire populations have been lost since 2002, primarily as a result of inadequate extent and connectivity of suitable habitat; declining for many years, Allt Dolanog was finally lost following a controlled burn that spread far beyond the intended area.

Tim Ward presented an analysis of the long-term butterfly and habitat monitoring from 2002-2026 (Common Standards Monitoring). Timed transects and annual quadrat surveys provide a valuable overview of population and habitat trends, but year-to-year results are noisy because of weather, difficult terrain, different surveyors and changing quadrat locations. Five-year rolling averages reveal clearer patterns, suggesting that the overall Montgomeryshire metapopulation has remained broadly stable despite contrasting trends at individual sites. The largest site, Golfa Common, supports the highest butterfly densities and is likely to be critical to the resilience of the wider population. Moderate violet abundance appears important for butterfly populations, high bramble cover is generally associated with lower violet and butterfly abundance, and nectar plants do not appear limiting at monitored

sites. However, the current survey design lacks the resolution needed to confidently assess the effectiveness of specific management interventions or identify optimal management practices.

The Pearl-bordered Fritillary in the Wyre Forest

Dr Jenny Joy with additional comment from colleague Mike Williams

Dr Joy described the long-term conservation of England's largest metapopulation of Pearl-bordered Fritillary in the Wyre Forest. Suitable habitat is maintained through a dynamic mosaic of coppice, clear-fells, wide rides, power-line corridors, railway margins and wood-pasture grazing, creating a network of both short-lived habitat patches and longer-lasting corridors. Monitoring has shown that butterflies readily colonise newly created habitat in high numbers, while rotational ride and railway verge management sustain smaller populations for many years. Habitat quality was associated with moderate violet abundance and a light tree leaf/bracken/grass litter layer, with Wood Sprurge (*Euphorbia amygdaloides)* and Wood False-brome (*Brachypodium sylvaticum*) used as indicator species of base-rich habitat.

The presentation highlighted several ongoing challenges, including vigorous Bramble (*Rubus fruticosus* agg.) and Bracken regrowth, bluebell (*Hyacinthoides* spp.) dominance, increasing waterlogging and the fragility of the PBF's habit of roosting high on Bracken fronds as extreme weather events increase. Preliminary studies of caterpillar ecology suggested that relatively low violet cover may be sufficient for breeding, while observations of Southern Wood Ant (*Formica rufa*) indicated a potentially important ecological relationship warranting further investigation.

A key theme was the value of long-term monitoring and adaptive management. PBF colony size counts have been undertaken since 2002. Research in 2011 showed the importance of existing site proximity for colonisation of new sites: PBF's largely favour sites within 0.5km, but will travel up to 4km. Face-to-face annual or biannual liaison between volunteers, Forestry England and Natural England allows survey evidence to directly influence management priorities. Changes to management, including wood pasture and rotational bracken cutting, have improved habitat continuity and butterfly abundance in some areas. Volunteer land management followed by cattle grazing of the early spring bite has been particularly effective.

Overall, the Wyre Forest experience demonstrates the importance of maintaining a shifting network of connected habitats at a landscape scale, supported by sustained monitoring and close collaboration between surveyors and land managers.

Countryside Stewardship Higher Tier Scheme

Dr Simon Spencer speaking on behalf of himself and Gareth Eggar of Natural England

Dr Spencer outlined the opportunities and challenges presented by the Countryside Stewardship Higher Tier option for target species habitat management in England. The scheme can provide funding for annual habitat management and scrub-control works, offering a financial incentive for landowners to manage habitat for Pearl-bordered Fritillary. However, eligibility requirements are stringent, including land registration, management control of the land, and support from Natural England. Access to the scheme is by invitation only and the application process can be complex and time-consuming, particularly where previous agreements, multiple holdings or administrative issues are involved.

Drawing on experience from the Nantmawr area, Dr Spencer described the decline of a formerly connected metapopulation spread across several holdings, with Pearl-bordered Fritillary now largely restricted to the Moelydd site. He highlighted the importance of securing long-term landowner engagement, grazing and habitat management support, while noting the challenges of restoring a metapopulation after local extinctions. Continued suitable habitat management for the remaining population, supported by grazing and scrub control, together with habitat restoration on adjacent sites, was presented as essential if recolonisation is to occur.

Pearl-bordered Fritillary on Dartmoor

Jenny Plackett, Butterfly Conservation South West Conservation Manager

Jenny Plackett described the management of Dartmoor's Pearl-bordered Fritillary and High Brown Fritillary (*Fabriciana adippe*) habitats on open, mainly south-facing Bracken slopes, including targeted summer and winter grazing, scrub control by volunteers, Bracken rolling, Roboflail and occasional controlled burning. She highlighted the Dartmoor Land Use Management Group’s recently started five-year trial at Newbridge Hill in the Dart Valley testing combinations of management techniques to restore neglected habitat.

Monitoring shows a long-term decline of around 38% on Dartmoor, broadly in line with the UK trend of 42%. Key concerns include the loss of populations from sites that appear to retain suitable habitat; and increasing bluebell, Bramble and Alder Buckthorn (*Frangula alnus*) cover. A new three-year Natural England Species Recovery Project will compare habitat condition with 1990s baselines, investigate drivers of decline including climate change and nitrogen deposition, test the effects of disturbance timing on violet abundance, and assess opportunities for habitat restoration and creation, and potential reintroductions on former sites. The project includes creation of a new Bracken Working Group, which attendees were invited to join.

Managing Bracken for Violets: High Brown Fritillary in the Alun Valley

Paul Dunn, with additional comment from Richard Smith

Paul Dunn described long-term practical management for High Brown Fritillary in the Alun Valley, a steep-sided valley with Bracken clearings within woodland. The volunteer team has employed coppicing, strimming, cattle grazing and a range of mechanical techniques to manage clearings, suppressing Bramble and Bracken and removing litter, or reducing its depth, to encourage violet regeneration. Areas managed in this way have achieved high violet cover and remained important breeding habitat for more than 30 years. Increasingly vigorous summer Bracken growth can still restrict access to otherwise suitable habitat. Winter disturbance treatments are consistently associated with subsequent breeding activity. The aim is to cut on a 5-year cycle.

Paul stressed the importance of locating and monitoring egg-laying and larval habitats rather than relying solely on adult transects. Fixed-point photography, accurate location recording and repeated observations of individual adults are being researched to quantify vegetation change and management outcomes. Drone imagery may also help distinguish previous cutting patterns and guide future rotational management.

Conservation grazing as a tool to manage PBF sites

Dr Simon Spencer speaking on behalf of Helen Upson of Pori Bach Grazing

Dr Spencer presented conservation grazing as an essential but often underappreciated component of long-term habitat management for Pearl-bordered Fritillary. Using Llanymynech Hill as a case study, he described repeated attempts to restore grazing across a complex landscape of golf course, nature reserves, SSSI and scheduled historic features. Earlier sheep-grazing schemes provided insufficient habitat management and proved difficult to sustain because of animal welfare, fencing and operational challenges. More recent work has combined extensive scrub clearance, stock-proof fencing and conservation grazing on some parts of the site with hardy cattle managed by specialist grazier Helen Upson (Pori Bach Grazing).

A key message was that successful grazing depends on a viable year-round grazing enterprise. Animals require suitable sites in different seasons, handling facilities, water supplies, transport, welfare checks and compliance with livestock regulations. Dr Spencer argued that specialist conservation graziers provide vital expertise and continuity, but current funding mechanisms often reward landowners while failing to adequately support the people undertaking the grazing itself.

Violets, ants and microclimate: *Myrmica* ants as keystone species and *Maculinea arion* as an indicator of rare niches in UK grasslands

Dr Zoe Randle

Dr Randle presented research on the ecological relationships between violets, *Myrmica* spp. ants and fritillary butterflies conducted on Dartmoor. Previous research had shown that violet spp. numbers and the invertebrate assemblage, including Pearl-bordered Fritillary, increased quickly after habitat management aimed at the Large Blue butterfly (*Phengaris arion).* Dr Randle's research demonstrated that different violet species occupy distinct microclimatic niches, with Common Dog-violet (*Viola riviniana*), the principal larval foodplant of Pearl-bordered Fritillary, associated with cooler conditions than Pale Dog-violet (*Viola lactea*). Violet abundance of both species was consistently higher above *Myrmica* ant nests than at comparable nearby locations, suggesting that ant-mediated seed dispersal may influence the distribution of larval foodplants. Ants carry the seeds with their fatty, protein-rich elaiosome appendages back to the nest to feed the young. A fellow PHD student's research into gorse seed showed healthier ant nests were associated with elaiosome consumption.

Dr Randle's research further demonstrated that Pearl-bordered Fritillary and Small Pearl-bordered Fritillary (*Boloria selene)* occupy different thermal niches associated with different *Myrmica* ant species. Pearl-bordered Fritillary selected the warmer egg-laying conditions also favoured by Scabrous Ant (*Myrmica scabrinodis*). She also found Small Pearl-bordered Fritillary preferred smaller flowers and Pearl-bordered Fritillary comparatively larger flowers.

Together, these findings highlight the importance of microclimate and species interactions in determining habitat suitability, rather than foodplant abundance alone. Climate change may alter the balance between the conditions favoured by violets, ants and butterflies, reinforcing the importance of maintaining a diversity of aspect, shade, litter and vegetation structure within sites.

Pearl-bordered Fritillary in Scotland

Anthony McCluskey, Butterfly Conservation Manager (Scotland) (Anthony was unable to attend but submitted at pre-recorded presentation)

Anthony McCluskey presented a largely positive picture for Pearl-bordered Fritillary in Scotland, where the species remains widespread and may be expanding into higher-altitude areas as the climate becomes more favourable. Successful sites combine warm, sheltered microclimates with south-facing slopes, moderate bracken litter, rocky ground, streams or gullies, nearby woodland and a suitable herb layer with Dandelion (*Taraxacum* agg.) and Bugle (*Ajuga reptans*) particularly important nectar sources. Forestry edges, woodland glades, livestock grazing, deer activity, paths, scarifying water movement and natural topographic variation all contribute to habitat suitability.

Two former colonies have declined likely because the bracken litter has become excessively deep, one site may have become too hot and bluebells have come to dominate the ground flora of the other. In the Trossachs intensive volunteer survey effort in an area of suitable habitat yielded only one record in nine years leading to an introduction programme based on predictive habitat modelling. This has resulted in the successful establishment of four areas of colonies, with natural spread expected between.

Overall, the Scottish experience suggests that Pearl-bordered Fritillary can persist across a wider range of habitats and landscapes than is often recognised. Its comparatively favourable status is likely to reflect a combination of habitat and landscape factors combined with the changing climate creating suitable conditions at higher altitudes.

PBF in Wales: Challenges, Lessons and Future Opportunities

Dr Simon Spencer

Dr Spencer reviewed lessons from four decades of Pearl-bordered Fritillary conservation in Wales. He described the species' marked decline and examined factors affecting several former and surviving populations. Key themes included the importance of grazing management, spring nectar resources, and controlling dense Bracken litter and Bramble, which can suppress violets. Evidence from monitoring and management trials suggested that moderate disturbance, including grazing, European Badger (*Meles meles*) activity, and Bracken cutting and raking, can benefit violets and improve breeding habitat.

Dr Spencer emphasised the need to manage sites as interconnected metapopulations, with habitat restoration targeted at former sites close to existing colonies. Reintroductions were considered a valuable conservation tool where suitable habitat and landowner support are in place.

He concluded that future recovery will depend on sustained habitat management, effective conservation grazing, improved management of commons, and maintaining sufficiently connected populations to support recolonisation and genetic resilience.

Malvern Hills Reintroduction of Pearl-bordered Fritillary

Mel Mason (Mel Mason was unable to attend the seminar but sent the 2026 report from the Malvern Hills Lost Fritillaries Project)

The report details the progress of the Malvern Hills Pearl-bordered Fritillary reintroduction programme, which aims to re-establish a self-sustaining metapopulation following the species' local extinction. Habitat restoration has focused on creating and connecting suitable breeding habitat through late-winter Bracken and scrub management, the creation of habitat corridors, and the promotion of Common Dog-violets. The project describes suitable habitat

as a mosaic of Bracken litter, violet-rich edges and sheltered flight corridors that support breeding, basking and dispersal.

Monitoring in 2026 provided encouraging evidence of establishment, with substantial numbers of unmarked butterflies recorded at release sites, indicating successful breeding and recruitment from previous generations. The report also highlights ongoing research into the relationships between soil conditions, Common Dog-violet distribution and Pearl-bordered Fritillary occurrence, alongside behavioural studies intended to improve understanding of habitat quality and breeding requirements. The project emphasises the importance of habitat connectivity and landscape-scale conservation to support a resilient metapopulation and facilitate future expansion.

Open discussion session

Grazing animals

Participants discussed pigs as a possible tool for disturbing soil, creating bare ground for violet establishment, reducing bluebells and breaking up Bracken litter. Jenny Plackett reported that Mangalitsa pigs had reduced bluebells and Bracken litter on High Brown Fritillary habitat, but had removed too much litter in some areas, which subsequently became grassy. She stressed that the timing of removal was critical. Jenny Joy described a Wyre Forest trial that did not create Pearl-Bordered Fritillary habitat; after five years, no difference remained between grazed and ungrazed areas. Kate Wollen also cautioned that uncontrolled Wild Boar (*Sus scrofa*) could damage existing breeding habitat.

The discussion emphasised the need for tightly controlled, site-specific trials rather than assuming pigs would be beneficial everywhere. Practical considerations included stocking levels, duration, the area available, suitable fencing, alternative land to move pigs onto promptly, and sufficient people to manage livestock and equipment. Electric fencing was described as a workable option; the suitability of collars for pigs is unknown. Participants also highlighted the limitations of commoners' grazing rights, landowner agreement and close cooperation with livestock owners. Monitoring would be needed to establish whether any initial disturbance produced lasting benefits for violets and fritillary breeding habitat.

Dave Wainwright recalled excellent grass suppression by rabbits at a commercial warren and questioned whether, in some areas, sheep grazing (more akin to rabbit grazing) may be preferable to cattle grazing.

Creating disturbance and bare ground without animal grazing

Mechanical scraping Diggers were used to expose bare ground on woodland ride edges where grazing was impractical. Kate Wollen reported suitable Pearl-bordered Fritillary habitat lasting around one or two years after scraping.

Chain harrowing was suggested for breaking up Bracken thatch and exposing soil. Tammy reported virtually no violet recovery after one horse-drawn trial in the Welshpool area; the reasons were unclear.

Robo-flailing Jenny Plackett and Paul Dunn reported strong violet growth following low cutting and surface disturbance, including on steep slopes. The Roboflail run in reverse strips the soil surface. Whether the regrowth was due to seed germination or vegetative reproduction remained uncertain although, in the Alun Valley, timing of the work in January/ February would suggest vegetative reproduction.

Aggregate piles beside foodplants Mike Slater described using stone and paving slabs next to Bird's Foot Trefoil (*Lotus corniculatus*) and Creeping Cinquefoil (*Potentilla reptans*) and oak slices next to Wild Strawberry (*Fragaria vesca*) in woodland to provide breeding opportunities for Dingy and Grizzled Skippers.

Removing cut material Participants raised concerns that leaving mulch could increase nutrients. Cutting and raking material off was suggested, although steep slopes and machinery limits make collection difficult.

Burning Several participants recalled good violet growth after fires, but stressed the risks of uncontrolled spread, consent difficulties and subsequent bracken regrowth.

Herbicide treatment Mike Slater reported successful ground clearance and efficiency of using Glyphosate herbicide treatment.

Cross cutting findings

Theme	Shared findings
Habitat structure	Adequate violets numbers alone are insufficient; breeding habitat needs warmth but not too much for the violets, shelter from extreme weather, suitable litter/ vegetation height and structural diversity.
Disturbance	Grazing, deer, paths, rocks, scarifying streams, cutting, raking and other disturbance can maintain open conditions.
Connectivity	Small, isolated colonies remain vulnerable even where individual sites are managed.
Monitoring	Current methods track broad trends but often cannot explain cause and effect.
Delivery	Effort and coordination between volunteers, landowners, contractors, graziers and agencies are all essential.

Recommendations

1. **Standardise monitoring — common national framework:** Agree a core of habitat variables and field definitions that can be recorded consistently across regions, while retaining optional local variables.
2. **Combine survey scales — rapid and detailed evidence:** Undertake frequent rapid assessments across many quadrats and periodic detailed surveys at fixed, accurately located plots.
3. **Record interventions — management audit trail:** Map the date, method, extent and intensity of every treatment so ecological responses can be attributed to specific actions.
4. **Manage mosaics — rotational structure:** Retain a shifting mix of open breeding patches, shelter, nectar resources, litter depths and connecting habitat rather than treating whole sites uniformly.
5. **Plan for climate resilience — microclimate diversity:** Protect cooler refuges, varied aspects, partial shade and topographic diversity while retaining warm breeding niches.
6. **Strengthen metapopulations — landscape recovery:** Prioritise restoration near occupied sites and maintain corridors or stepping stones that allow recolonisation.
7. **Support conservation grazing — viable delivery model:** Develop payments and multi-site agreements that directly support graziers, livestock care, handling infrastructure and year-round land requirements.

8. **Coordinate research — shared learning network:** Use the proposed working group and future seminars to exchange protocols, trial results, failures and research needs.

Priority Research Questions

- Which combinations, timings and techniques of grazing, cutting, rolling, raking, burning and flailing produce the best breeding habitat?
- How do temperature, drought, wetter winters and reduced snow cover affect violet germination, larvae, litter structure and adult emergence?
- What roles do nitrogen deposition and soil conditions play in site deterioration?
- How important are ants, parasites, genetics and other biological interactions to persistence and recovery?
- Where should conservation efforts be focussed? Opportunity mapping for appropriate historic sites for restoration, connected sites for metapopulation expansion and new sites for climate change mitigation.
- What should be the protocol for PBF reintroductions?
- How can grazing and mechanical management be financed sustainably across networks of sites?

Conclusion

The seminar brought together researchers and practical land managers with substantial commitment, ingenuity and accumulated field experience. The discussion confirmed that the Pearl-bordered Fritillary cannot be conserved by maintaining isolated patches of violets or by delivering occasional clearance. Recovery depends on continuing disturbance, varied microclimates differing according to local biotic and abiotic conditions, connected landscapes, reliable monitoring and the commitment of people who sustain management year after year.

There is encouraging evidence from Wyre Forest, Scotland and long-managed sites that populations can persist or expand when habitat mosaics and partnerships are maintained. The immediate priorities are to convert dispersed experience into shareable guidance, develop standardised monitoring protocols and coordinate trials for knowledge development, and to explore opportunities for establishment and development of metapopulations.

Proposed follow-up actions

Action	Suggested lead	Timing
Convene a PBF Working Group to action recommendations with an immediate focus on monitoring and information sharing.	Tammy Stretton	Before the next survey season
Establish the Bracken working group and maintain a shared register of trials.	Species Recovery Project team	Initial meeting within the next few months
Identify priority occupied, restorable and connecting sites in each landscape.	Practitioners, eNGOs, university depts as funding allows.	During annual management planning
Develop proposals for sustainable grazing support and multi-site agreements.	Landowners, trusts, graziers and statutory agencies	Alongside funding and stewardship applications