

Experimental bracken *Pteridium aquilinum* control to restore habitat for the heath fritillary *Mellicta athalia* at Bin Combe, Holnicote Estate, Somerset, England

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SUMMARY

A core heath fritillary *Mellicta athalia* breeding site had become dominated by bracken *Pteridium aquilinum*. Following bracken control by burning and herbicide spraying there was a considerable increase in common cow wheat *Melampyrum pratense* (the larval food plant) and a 10-fold increase in fritillary numbers. There had also been grazing and trampling by red deer *Cervus elaphus*, which might have also improved the habitat quality. Two other burnt and sprayed areas did not show an increase in butterfly numbers, perhaps because at higher elevation and therefore constituting less suitable habitat.

BACKGROUND

In a major review in 1989 of the status of the heath fritillary *Mellicta athalia* in the UK, Exmoor in southwest England was confirmed as the most important region for this butterfly, holding more than 50% of the UK's colonies. The Holnicote Estate supported 13 of these, including some of the largest colonies in the UK. However, ten years later, in 1999, surveys in Exmoor showed that the fritillary had declined from 29 colonies to only 15. Most of the sites at the Holnicote Estate also showed a substantial decline in numbers.

During this period, based on the limited knowledge of the ecology of the species, the National Trust view had been that the management of these sites should be based on a non-intervention strategy. However, together with several consecutive years of extremely poor weather during the crucial flight period and substantial changes in grazing regimes on the moorland areas that they occupied, it was believed the butterfly was on the verge of extinction across the whole of Exmoor.

Despite these generally adverse conditions, one colony at Alcombe Common had continued to thrive. This area had been managed by regular rotational burning. This prevented succession of vegetation and litter build-up, both of which can shade out the main heath fritillary larval food plant, common cow-wheat *Melampyrum pratense*. Therefore, in March 2000, with only a handful of heath fritillary butterflies

surviving in a few locations on the estate and under the guidance of M. Oates (Nature Conservation Adviser), the team of wardens implemented a management recovery programme to improve habitat conditions at Bin Combe, one of the key sites remaining on Holnicote. It was believed that key to the butterflies' recovery would be increasing the abundance of cow-wheat which had diminished due to shading out by taller competing vegetation such as bracken *Pteridium aquilinum*, and litter build-up.

ACTION

Study site: Bin Combe, on the Holnicote Estate in Exmoor, was formerly a core heath fritillary breeding area. However, by 2000, it was heavily bracken-dominated. There was patchy bilberry *Vaccinium myrtillus* cover (also important breeding habitat) but very little cow-wheat was evident. It was decided to experiment with burning and follow-up herbicide spraying on 'Section 3' of the butterfly transect used to monitor the population. There was also some burning and spraying on Sections 1, 2 and 4.

As Bin Combe is a steep sided valley, the initial burn was managed by making use of a specially adapted 'Supercat' all terrain vehicle (with a fogging unit and the capacity to carry heavy loads of water) for better control of fires. This was purchased through the Exmoor Fire Partnership which included the National

Trust, Exmoor National Park Authority and Somerset Fire Brigade.

Control of bracken on an experimental site (Section 3): On 4 March 2000, 1 ha of heavy bracken cover was burnt. Then on August 4 2000, the live bracken fronds were sprayed with Asulox (a herbicide commonly used to control bracken) according to manufacturers specifications.

In August 2004, 50% of the burn area was sprayed again with Asulox due to increasing density of bracken.

Control of bracken on additional sites (Section 1 and 2): On 20 March 2003, Sections 1 and 2 of the transect were burnt. This area was approximately 5-ha in size and more than trebled the experimental area (Section 3). However, it is believed the habitat in Section 1 and 2 has lower potential than Section 3. Bilberry was locally common, but there was no evidence of cow-wheat. In July 2003, the densest areas of live bracken were sprayed with Asulox.

Control of bracken on additional sites (Section 4): In January 2003, a heavily gladed area (approximately 3-ha in size) of tall European gorse *Ulex europaeus*, formally a core heath fritillary area, was swiped to create smaller more manageable blocks/firebreaks for future planned burns. Swiping was repeated in 2004 and in Jan/Feb 2005 the area was burnt. Follow-up herbicide spraying proved impossible due to the abundance of blackened gorse stems. Due to concerns about the amount of litter left after swiping, it was decided that in February approx 1.5-ha of the burnt gorse would be cut by chainsaw, gathered and burnt in bonfires to ascertain if there was any advantage to bilberry regeneration compared to swiping only. The effects of this are yet to be established.

Butterfly monitoring: Annual butterfly transects made up of six sections are monitored weekly, every year between the end of May and the beginning of July. Transects are walked at a slow steady pace. The number of heath fritillaries on either side and ahead of the observer, are recorded on a standardised pro forma. Counts are made during the day and only when certain weather criteria are met (warm, bright, with light winds).

Vegetation monitoring: In order to assess vegetation regrowth and colonisation, 1 m²

quadrats were laid at random throughout Section 3 of the transect. Vegetation composition and structure was recorded within each quadrat during the heath fritillary peak flight period from 2000-2004. An assessment of bracken density and vigour, cow-wheat density and cover of other vegetation was made.

CONSEQUENCES

Effect of bracken control on vegetation in the experimental site (Section 3): Three months after burning, in late June 2000, there was evidence of bilberry growth and a few small patches of cow-wheat had appeared. After spraying with asulox, monitoring in 2001 indicated that bracken was sparse and patchy, with low and weak re-growth. The section had a sparse understory of bilberry some five centimetres tall, amongst which cow-wheat occurred very locally. By 2002, cow-wheat was present in 75% of 1 m quadrats amongst a 10 cm high cover of open bilberry. Bracken was recovering sparsely, ranging from 20-30 cm in height. Red deer *Cervus elaphus* had been very active in the section over winter, browsing bilberry.

By 2003, the area held a 60% cover of open, low (knee high) bracken and numerous open glades. There was 80% open cover of 10 cm tall bilberry, which had been grazed heavily by deer over winter and as a result in the autumn was hardly fruiting. There was flowering cow-wheat in 60% of 1 m quadrats. Observations indicated bramble *Rubus fruticosus* (an undesirable species in terms of habitat management as it can rapidly grow and swamp smaller herbs such as cow-wheat) was spreading low over the ground in several places.

In 2004, the area consisted of a 10-20 cm open carpet of bilberry with little cow-wheat evident, perhaps because of extensive heath fritillary larval damage. Grass, especially bristle bent grass *Agrostis curtisii*, covered about 20% of the area, and low, sparse bracken about 40%. Deer were active again during the winter, attracted by bilberry and grasses.

After re-spraying in August 2004, monitoring in 2005 indicated the section looked superb for the heath fritillary. It had a sparse cover of low bracken, an extensive open carpet of low bilberry that contained much cow-wheat, and a modest amount of other vegetation (purple

Table 1. Heath fritillary *Mellicta athalia* annual transect counts and management divided by transect section, 1999 to 2004.

Date	Transect sections									
	Count	1 Management	Count	2 Management	Count	3 Management	Count	4 Management	5 Count	6 Count
24 June 1999	0		3		5		2		0	0
02 July 1999	0		2		1		2		0	0
08 July 1999	0		9		7		0		0	0
1999 average	0.00		4.67		4.33		1.33		0.00	0.00
31 May 2000	0		0		0	4 Mar 00: 1-ha heavy bracken cover burnt.	0		0	0
19 June 2000	1		1		6	4 Aug 00: Live bracken fronds were sprayed with Asulox	5		1	0
24 June 2000	0		3		3		6		4	0
19 July 2000	0		0		0		0		0	0
2000 average	0.25		1.00		2.25		2.75		1.25	0.00
11 June 2001	0		0		0		0		0	0
21 June 2001	0		2		9		3		0	0
02 July 2001	0		0		5		0		0	0
2001 average	0.00		0.67		4.67		1.00		0.00	0.00
18 June 2002	0		0		14		0		1	2
26 June 2002	0		0		17		2		0	0
04 July 2002	0		1		8		0		0	0
2002 average	0.00		0.33		13.00		0.67		0.33	0.67
02 June 2003	0	20 Mar 03: Sections 1 & 2 burnt (approx 5-ha total). (Bilberry locally common, but no cow-wheat evident)	0	20 Mar 03: Sections 1 & 2 burnt (approx 5-ha total). (Bilberry common, no cow-wheat evident)	5		0	Jan 03: Approx 3-ha of gorse swiped to create smaller more manageable blocks for future burning	1	1
07 June 2003	0		0		5		1		0	1
12 June 2003	0		0		23		6		0	4
22 June 2003	0	Jul 03: Sections 1 & 2, live bracken sprayed with Asulox.	0	Jul 03: Sections 1 & 2, live bracken sprayed with Asulox.	30		0		0	1
2003 average	0		0		15.75		1.75		0.25	1.75
24 May 2004	0		0		10	Aug 04: 50% of 2000 burn, resprayed with Asulox (bracken had increased in density)	2	Swiping	0	2
03 June 2004	0		15		87		4		1	2
07 June 2004	0		11		39		10		1	10
15 June 2004	0		0		51		0		0	0
2004 average	0		6.5		46.75		4		0.5	3.5

moor-grass *Molinia caerulea*, bristle bent and bramble).

Effect of bracken control on vegetation at additional sites (Sections 1, 2 and 4):

For sections 1 and 2, monitoring in 2005 indicated that burning and spraying had led to cow-wheat and bilberry recovery in a few areas, especially in the lower parts of section 2. In Section 4, monitoring in 2003, indicated that swiped areas showed good bilberry regeneration but there was hardly any cow-wheat present.

Effect of bracken control on heath fritillary numbers in the experimental site (Section 3):

The heath fritillary annual transect counts alongside the management techniques from 1999 to 2004 are presented in Table 1. The counts show that in 2004, there was a spectacular increase in heath fritillary numbers in Bin Combe, with the experimental hectare in section 3 clearly a major breeding ground. This was also the case in 2005, where numerous females were observed and stalks of cow-wheat eaten by larvae could be easily located.

Effect of bracken control on heath fritillary numbers on additional sites (Sections 1, 2 & 4):

Since 1999 on Sections 1 and 2, the highest number of heath fritillaries recorded was nine in 1999. Only three had been recorded in two years before burning and spraying, all in Section 2. After burning, in 2004, no heath fritillaries were recorded in Section 1, but a maximum of 15 were recorded during one count in section 2.

For section 4, it is unclear whether swiping has had a positive effect on the number of

fritillaries. This is also the case for the burning which occurred in 2005. Monitoring is ongoing and results of the 2006 count are pending.

Conclusions: It is evident that since burning and spraying in Section 3 in 2000 (and re-spraying in 2004) the area quickly developed into a core heath fritillary breeding ground, with fritillary numbers increasing dramatically. However, this area had been strongly favoured by the butterfly in the recent past and perhaps had not deteriorated too badly. Another potential cause of habitat improvement could be the grazing and trampling by red deer, particularly during winter, creating favourable gaps for cow-wheat and bilberry (although the latter may have been a little too over-grazed). The burnt and partially-treated areas in sections 1 and 2 have yet to respond convincingly. However, these sections are likely to have lower potential, being at higher elevation which is less attractive to heath fritillaries.

After the apparent success in Bin Combe the warden team at Holnicote decided to undertake a controlled burn at Halse Combe where the butterfly once had its Exmoor stronghold. McCracken and colleagues (2005) have outlined the result of this management.

REFERENCES

McCracken M., Bulman C., Camp P. & Bourn N. (2005) *Heath Fritillary habitat management: A three-year experimental study at Halse Combe, Exmoor*. Butterfly Conservation, Wareham, Dorset, UK. Report no. S05-44.