Natural England Technical Information Note TIN047

Bracken management: ecological, archaeological and landscape issues and priorities

For over sixty years research has been carried out on the ecology, management and control of bracken *Pteridium aquilinum*. Much of this has been aimed at discovering the best methods of control where it has invaded plant communities of higher conservation value, such as heathland and unimproved grassland. More recent research has focussed on the damage it may do to archaeology. Conflicts between different environmental interests can arise where bracken is present. Where they do it is important that any decisions on management are made in the light of the best information available and that the proposals are sustainable. This note identifies some of the issues and suggests priorities in a number of conflict situations. Further information is available in SIN011 *Bracken* and the TIN048 *Bracken management and control.*

Bracken and Biodiversity Action Plan (BAP) priority habitats

Grassland

Bracken grows best on deep well drained soils. It will invade grassland on acid and neutral soils. It is less likely to be a problem on calcareous grasslands. Where it grows on acid grassland around moorland edges, it is of particular concern because of its negative impacts on valuable grassland communities. In these moorland edge habitats, enclosed areas containing acid grassland are recognised by the UK Biodiversity Action Plan as the priority habitat *Lowland Acid Grassland*.

In more productive grassland bracken tends to be controlled by heavy stock grazing or cyclical cultivation and re-seeding. In the uplands bracken will most readily invade U4 bent-fescue grasslands.

At certain levels of grazing grassland can be maintained beneath bracken without a significant build up of bracken litter. These grasslands can be of value to agricultural stock, particularly in late summer when other grasslands have become scorched and less palatable.

Heathland

Both lowland and upland heath are considered of international importance and recognised as BAP priority habitats. They both may be invaded by bracken. In areas of established and healthy heath, bracken may only increase slowly. However, in fragmented heath bracken densities can increase rapidly.

On heath, and particularly in the case of upland heath, fire is commonly used as a management tool. This can lead to the spread of bracken as it is well placed to survive fire due to its deep rhizome system that is likely to remain largely unaffected by heath fires. Following a heath fire rhizomes sprout vigorously and can be the first green to show through the ashes. In addition late summer and autumn fires offer ideal opportunities for colonisation by bracken from spores.

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Woodland

Bracken spores preserved in peat have shown its early native occurrences to be as a minor element in the woodland flora. In woodland it survives in glades and ride edges. When light intensity drops below 25% of full sunlight bracken cover may be as low as 5%. However, in managed woodland with an open canopy, or where grazing has denuded the understorey, bracken can dominate the shrub layer.

Bracken stands are found commonly in a number of woodland types, in particular oak/birch woodland, and beech woodland. Bracken may be present, and even frequent, in other woodland types, but cover is likely to be low. Old woodlands are likely to have the least bracken.

Bracken and UK BAP species

Two UK BAP fritillary butterflies: high brown and pearl-bordered fritillary, are closely associated with stands of bracken that have violet species growing profusely through a thin layer of litter. Heath fritillary is also a UK BAP priority species and its caterpillars feed on cow-wheat, often where it is growing under a bracken canopy.

These bracken habitats are now considered crucial for many populations of high brown and pearl-bordered fritillary. The meta-population survival strategy means colonies may react to changes in habitat conditions and to pest species by becoming extinct at one site and moving on to another site. The maintenance of a number of sites in suitable condition within the meta-population range is essential to the survival of the species. Thus, a bracken stand within a meta-population range and with the correct attributes for breeding fritillary butterflies may be of high importance even if the species is not present.

Nightjar is the only UK BAP bird species with close associations with bracken. It may use bracken as its preferred habitat, and birds may lay their eggs on bare ground under bracken. Skylark, another UK BAP species, often nests in habitats that contain bracken and will use bracken for cover.

Black grouse is a UK Red List and UK BAP species and has a minor association with bracken as part of a wider habitat mosaic. They may use small patches as refuge from predators, particularly during moult. Whilst there is no evidence of black grouse feeding from bracken, birds will utilise a good herb rich ground layer where this is present. Control of bracken is usually advised for black grouse where there is perception that bracken encroachment will be detrimental to other more valuable habitats.

Bluebell is a UK BAP plant species with between a quarter and a half of the world population in Britain. It is often found under bracken stands, where it flowers before the bracken canopy closes in the summer. This species is intolerant of trampling, heavy grazing, deep shade and competition from vigorous grasses, therefore the conditions below many bracken stands are suitable.

Other species associated with bracken

Mammals

A number of mammals use bracken as shelter and cover, in addition a small number will occasionally eat it. Smaller mammals may use bracken stands that have a well developed litter layer throughout the year. Larger mammals find little or no winter shelter or cover in bracken, although some deer may use them to provide cover for giving birth, particularly where sited near a woodland edge. The effects of deer grazing in bracken stands may benefit fritillary butterfly colonies. Rabbits may occasionally eat bracken, but are generally thought to encourage it by eating competitor plants.

Birds

No bird species are completely dependent upon bracken, the ones most commonly associated with it are whinchat and stonechat. Both are known to nest and feed within the stands. Other birds known to nest in, or beneath, bracken include willow warbler (it will also use bracken to construct its nest), tree pipit, yellowhammer, ring ouzel, woodcock and twite.

Meadow pipit, tree pipit, yellowhammer and wren all use bracken for cover and foraging.

Mistle thrushes have been spotted foraging in bracken patches on open moorland in June and July.

Where twite are present the RSPB advise that small patches of bracken are retained on steep slopes for twite to nest under. If management is necessary, it should be done as late as possible (ideally August). Note, twite is a colonial nester so destruction of core sites and the availability of suitable sites can be a limiting factor to expansion.

Reptiles and amphibians

In the spring adders may be found basking on dead bracken where their camouflage conceals them well. It may be that they take advantage of the higher temperatures on the surface of bracken litter compared to surrounding vegetation.

Invertebrates

There are a number of invertebrates that feed on bracken. For instance, the sawfly *Strongylogaster lineatus*, a plant hopper *Dytroptis pteridis* and the caterpillar of the moth map-winged swift *Hepialus fusconebulosa*. In the UK it is thought that between 27 and 40 different insects feed on bracken, including nine moth species. Of these, the larvae of map-winged swift and brown silver-line *Petrophora chlorosata* and the species *Paltodora cytisella* are thought to be confined to bracken.

The number and frequency of insects feeding on bracken increases as the season progresses, possibly as a result of decreasing levels of toxins in the bracken. Also young bracken fronds produce extrafloral nectaries sited in the axils of the pinnae and pinnules. These are only active in early spring and provide food for ants that in turn may provide the bracken with some protection from invertebrate herbivores.

There is evidence that bracken is a good habitat for orb-web spiders and provides good wind-shelter for flying insects.

Higher Plants

The higher plants associated with bracken are mainly those of woodland or the woodland edge. Among the more notable of the higher plants is the wild gladiolus. It is confined in Britain to the New Forest and always found beneath a canopy of bracken. Climbing corydalis and chickweed wintergreen also seem to benefit from the conditions found under bracken stands.

Other ferns

A range of ferns thrive on acid heaths and uplands, including:

- Lady fern *Athyrium filix-femina*
- Hard fern *Blechnum spicante*
- Moonwort *Botrychium lunaria*
- Parsley fern *Cryptogamma crispa*
- Mountain male fern *Dryopteris oreades*
- Scaly male fern *Dryopteris affinis*
- Broad buckler-fern *Dryopteris dilitata*
- Wilson's filmy-fern *Hymenophyllum wilsonii*
- Lemon-scented fern *Oreopteris limbosperma*

Any of the above might be found growing in close association with bracken. However, the likelihood of this will be far greater where bracken is less dense or at the edge of bracken stands. All ferns are susceptible to damage from herbicides used to control bracken and most are severely affected.

Lower plants

Bracken canopies generally retain relatively higher humidity levels than those found in open grassland. This favours mosses, which are often found under bracken. A number of moss species even grow under vigorous, dense bracken canopy, including, *bryum* species, *Campylopus flexuosus*, *Hypnum cupressiforme*, *Polytrichum commune*, *Pseudoscelopodium purum* and *Rhytidiadelphus squarrosus*.

Fungi

There are a number of fungi that can be found growing beneath the bracken canopy. Many, such as the yellowleg bonnet *Mycena epipterygia*, are woodland fungi. At least one, *Camarographium stephensii*, is host specific to dead stems of bracken.

Bracken and archaeology

Bracken has two major impacts on archaeological sites. Firstly, it destroys and

reduces the significance of sub-surface archaeological evidence, including the ability to reconstruct past environments. Secondly, it obscures sites. Each summer until mid-winter a large part of our rural archaeological heritage disappears under the cloaking effect of bracken. Not only does this reduce the accessibility to, and visibility of sites, it also makes them more vulnerable to inadvertent damage, for instance from agricultural or forestry operations.

The bracken canopy hides low level upstanding archaeological features and field marks in grassland and unrecorded sites are unlikely to be found, recorded, studied or protected. A complete canopy of bracken indicates a substantial rhizome system and the high probability of ongoing damage to an archaeology.

Research work on archaeological sites in Scotland and on Dartmoor has shown that the rhizome system develops as a dense mat between up to 20 cm and 40 cm below ground surface. Beneath this there is a thinner riddling effect between 40 cm and 90 cm. This indicates that all deposits near the surface may be completely destroyed, while the palaeo-environmental integrity and content of the underlying deposits will increasingly be compromised.

Bracken may also discourage grazing stock, particularly as it dominates grass and herb species which in turn can lead to scrub invasion. Whether scrub is the lesser of two evils as concerns damage to archaeology is another matter. Dense stands of bracken can prevent infestation by rabbits and it may not be advisable to control bracken where rabbits pose a threat to a site.

From purely historic environment interests the best control on archaeological sites where there are upstanding remains (either earthworks or stone structures) is by spraying with an appropriate chemical. However, chemical spraying to control and eradicate bracken from extensive areas of archaeological landscape could have potentially serious implications for the carbon load in, and the quality of, water.

Bracken in the landscape

Bracken has existed as a component in the landscape for millennia. The form that bracken stands take in the landscape are varied, but may be said to fall into two categories: continuous, relatively uniform stands, and discontinuous, relatively patchy distribution. The visibility of the stands depend on their position in the landscape which may be on open hillsides or in more confined situations, perhaps adjacent to woodland, where stands may less visible.

Continuous stands will be constrained by elevation and exposure, by ground-water and by the interaction with other vegetation communities such as heathland or woodland. On low open hillsides bracken may completely cloak the landscape. On hills and moorland that rise to greater elevations an elevational limit defines the limit of the vegetation. The shape of the upper limit may be defined by topography and exposure. The shape of the lower limit may be defined by the enclosed and more intensively managed land or by woodland.

Discontinuous stands on open hillsides may form a mosaic of lesser or greater intensity. They may rise up along valleys and stream-sides or be confined to the lower areas of the hillsides and remain fragmented due to intensity of grazing or other management.

Where bracken control or management is to be implemented the boundaries of treatment areas need careful consideration, particularly in relation to the impact they could have in the landscape.

Principles for integrating management

The main objective of any management should be the protection and maintenance of the environmental feature or features of the highest value. In some cases the enhancement of high value features will be at the expense of features of lesser value even where those may be in better condition.

The general principle is that international designations will take precedence over national designations. National designations will take precedence over regional designations with

regional designations having a higher priority over local designations or importance.

Two issues that may cause concern in setting priorities are:

- Where two or more feature on a site are similarly designated.
- Where management for the feature of highest priority will severely damage or destroy a feature of high, but not as high, value.

Bracken is unlikely to be a feature of high value in its own right. As has been shown above, it is mainly the conditions created by bracken that are important. A number of the species associated with bracken are of high conservation value. Management of bracken at a greater or lesser degree would normally continue to provide suitable conditions for these species. However, bracken is highly damaging to archaeology.

To resolve a conflict between management of bracken for associated values and control of bracken to protect archaeological features consideration must be given to the scale of the archaeological feature or features and the form that they take. It may be necessary to take informed opinion as to the value of the archaeological feature to assess its value relative to other features. In some cases archaeology will be designated. Very few archaeological sites have international designations. There are a great many that are designated as Scheduled Monuments of national importance and numerous features are listed on the County Sites and Monuments Register.

Only Scheduled Monuments receive legal protection in this country. However, where land is under an agri-environment Scheme agreement all features of archaeological or historic value or interest must be protected from any damage, destruction or removal. Hence, on agri-environment land, where a conflict is perceived, protection of archaeological features will take precedence.

Where archaeological and ecological interests coincide it is often possible to tailor control and management to the benefit of both interests.

While the finest of archaeological sites may cover may hectares of land it is often the case that bracken affecting isolated features can be controlled without damaging ecological interest. Indeed, it may be possible, and it is always desirable, to carry out control and management with integrated objectives.

Case studies

An example of integrated management is Spitchwick Common on Dartmoor where an attempt is being made to control bracken on and around archaeological features that coincide with fritillary butterfly interest. The bracken control aims to protect the archaeological sites from any further damage while creating grazing lawns. The fresh grass should encourage stock into the butterfly habitat keeping it in favourable condition.

Another case of integrated management can be found on Ugborough Common, also on Dartmoor, where the agricultural and environmental objectives are integrated. Here the commoners are managing bracken on the lower parts of the common in order to produce more sweet grazing for stock. The stock will be shepherded towards this new grazing away from higher value Upland Heath.

Prioritising management between conflicting archaeological and ecological interests

Where conflicts between different environmental features arise the following methodology can be used to help determine the most appropriate management for a given site. This methodology is based on *What are the management options in Bracken Control?: a Guide to Best Practice* produced by The Southern Uplands Partnership, Galasheils, March 2001.

In table 1 overleaf there are four management options:

- no control,
- maintenance or conservation management,
- limited control and
- eradication.

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A decision on the approach or approaches in any given situation will depend on the comparative values of the features on that site.

Table 2, overleaf, sets out the comparative values of a range of features. Where conflicts may arise there is normally a need to decide on a course of action.

Table 3, on page 8, sets out the relative priority for management where conflict between two features arises. Where a balance of management is called for it may be possible, within a site, to control bracken on features where it is desired while managing the bracken away from those features, preventing invasion yet maintaining conditions suitable for the other interest feature.

Further information

This document has been developed from guidance written by the Rural Development Service for Environmentally Sensitive Areas Project Officers in the South West Region.

Natural England Information Notes are available to download from the Natural England website: **www.naturalengland.org.uk**. In particular SIN011 and TIN048:

- *Bracken*
- *Bracken management and control*

For information on other Natural England publications contact the Natural England Enquiry Service on 0845 600 3078 or e-mail **enquiries@naturalengland.org.uk**.

Table 1

Management options	Situation
No control	On steep slopes, heavily grazed areas or where regeneration of other habitats to replace bracken is difficult and where wildlife considerations are important
Conservation management	Where it is desirable to maintain low intensity or patchy cover for supporting species and habitats for conservation importance, any control is likely to be limited and selective
Limited control	Where the aim is to reduce the area or severely limit vigour and spread but not eliminate
Eradication	Where bracken is to be replaced with other vegetation

Table 2 Interest features associated with bracken and their relative importance

	International	National	Regional	Local
Landscape		Historic Parks and Gardens		
Archaeology	World Heritage Sites	Scheduled Monuments, Unregistered Features	County Register sites, Unregistered Features	Unregistered Features
UK BAP Prioirty Habitats	Upland heath, Lowland Heath, Lowland Acid Grassland, Lowland pastures, Upland Oakwood			
UK BAP species	Nightjar, skylark, high brown fritillary, pearl-bordered fritillary, heath fritillary, Vigurs eyebright, bluebell			
Other Species		Twite, Yellowhammer, Ring Ouzel, Tree Pipit, Meadow Pipit, Stonechat, Woodcock, Willow warbler, Adder, Wild Gladiolus, Moonwort, Parsley Fern, Wilsons Filmy Fern	Brown Silver-line, Map-winged Swift, Orange Swift, a gall-midge *Dasyneura filicina*, Climbing Corydalis, Chickweed Wintergreen, Mountain Male Fern, Lemon Scented Fern	Wren, Whinchat, Mistle Thrush, Gold Swift, Buff Ermine, Broom Moth, Angle Shades, Small Angle Shades, a micro-moth *Paltodora cytisella*, Lady Fern, Hard Fern, Scaly Male Fern, Broad Buckler Fern

Table 3

Site Designation	UK BAP species	nationally notable species	regionally notable species	locally notable species
World Heritage Site	balance management	balance management	control bracken	control bracken
Historic Park or Garden	balance management	balance management	control bracken	control bracken
Scheduled monument	balance management	balance management	control bracken	control bracken
SMR	balance management	balance management	control bracken	control bracken
UK BAP Habitat	balance management	control bracken	control bracken	control bracken
Nationally Important Habitat	manage for UK BAP sp	balance management	control bracken	control bracken
UK BAP species	x	manage for UK BAP sp	manage for UK BAP sp	manage for UK BAP sp
Nationally notable species	x	x	manage for Nat sp manage for Nat sp	
Regionally notable species	x	x	x	manage for Regional sp
Locally notable species	x	x	x	x