New Forest SAC Management Plan Version II

Part 1: Description of the New Forest SAC NERR148

Date: 2020

Published 2025

NATURAL ENGLAND

www.gov.uk/natural-england

Contents

Summary description of the New Forest SAC

The New Forest SAC is one of the most important sites for wildlife in the United Kingdom and is widely recognised as being of exceptional importance for nature conservation in a European context.

It supports a complex mosaic of wildlife habitats, formerly common in lowland western Europe but now rare and fragmented. The major components are the extensive wet and dry heaths with their rich valley mires and associated wet and dry grasslands, the ancient pasture and enclosed woodlands, the network of clean rivers and streams and frequent permanent and temporary ponds. Outstanding examples of 13 habitats of European interest are represented together with two Priority Habitat types, namely bog woodland and riverine woodland.

The habitats support an exceptional variety of plants and animals. This includes the richest moss and lichen flora in lowland Europe, scarce flowering plants such as slender cotton-grass, wild gladiolus, pennyroyal and small fleabane and an outstanding community of invertebrates dependent upon the ancient forest trees and other grazed habitats. In addition, the New Forest has the largest number of Dartford warbler in Britain and internationally important populations of nightjar and woodlark. The populations of southern damselfly in boggy flushes along stream sides are of particular note as well as great crested newt in the ponds and stag beetle associated with the rich dead wood resource in the New Forest.

The quality of the habitats of the New Forest and the rich diversity of species which they support is dependent upon the management activities of the various owners and occupiers. Of fundamental importance throughout the Crown Lands and Adjacent Commons is the persistence of a pastoral economy based on the existence of Rights of Common. The commoners' stock, mainly cattle and ponies, roam freely over extensive areas of the New Forest, playing a vital role in keeping open habitats free of scrub and controlling the more aggressive species such as bracken and purple moor-grass; and maintaining the richness and variety of heathland and wood pasture habitats. This is complemented by the prescribed annual heathland burning and cutting programmes which ensure that at any one time there is an extensive range of structurally diverse habitats available for plants and animals to utilise.

New Forest non-technical description

Location

The New Forest SAC is situated on the south coast of England in the counties of Hampshire and Wiltshire. It lies immediately to the north of the Solent, between the major conurbations of Bournemouth to the west and Southampton to the east. The extensive chalk landscapes of Salisbury Plain and the west Wiltshire Downs lie to the north. The SAC comprises seven SSSIs which together cover more than 29,000 hectares. The component sites in Hampshire are The New Forest SSSI and Roydon Wood SSSI, while in Wiltshire are Langley Wood and Homan's Copse SSSI, Landford Bog SSSI, Loosehanger Copse and Meadows SSSI and Whiteparish Common SSSI.

(While the SAC contains most of the Lymington River SSSI headwaters, the riverine features themselves have not been selected for SAC designation in their own right but are within the New Forest SPA and New Forest Ramsar site.)

Tenure

Over 90% of the SAC is Crown Land managed by Forestry England, comprising most of the unenclosed land and the woodland Inclosures. There are however, around 55 private owners and occupiers managing significant areas of SAC habitats. Other significant landowners and managers include the National Trust (Bramshaw Commons, Rockford and Ibsley Commons, Hightown Common and Hale Purlieu), Hampshire Wildlife Trust (Roydon Wood), Hampshire County Council (Hyde and Gorley and part of Rockford and Ibsley Commons) and Natural England (Langley Wood) and most recently the Royal Society for the Protection of Birds which has purchased Franchises Wood. The Crown Lands, Adjacent Commons and Manorial Wastes are bounded by the New Forest 'perambulation' which encloses some 37,907ha. Historically the perambulation was the limit of the area within which Forest Law had jurisdiction—and it was considerably larger in extent than today. Currently it delimits the area within which the New Forest Verderers apply their by-laws for the control and health of stock depastured on the Crown Lands, Adjacent Commons and Manorial Waste and within which the animals are contained by cattle grids and fencing.

Management

The maintenance of the habitats and species for which the New Forest is of international importance is dependent upon the management activities of the various owners and

occupiers and commoners. Of fundamental importance throughout the Crown Lands and Adjacent Commons is the persistence of a pastoral economy based on the existence of Rights of Common and mast. The commoners' stock, mainly cattle and ponies, roam freely over extensive areas of the New Forest unenclosed lands, playing a vital role in maintaining open habitats free of scrub and controlling the more aggressive species such as bracken and purple moor-grass, as well as maintaining the richness and variety of heathland and wood pasture habitats. This is complemented by the prescribed annual heathland burning and cutting programmes which ensure that at any one time there is an extensive range of structurally diverse habitats for plants and animals to utilise.

Geology, soils and geomorphology

The New Forest is underlain by the clays and sands of Tertiary deposits consisting of a series of marine, fluviatile and estuarine deposits of clays, clay marls and sands. These are overlain by extensive sheets of more recent gravel and Brickearth. Apart from a few of the strata, including the clay marls, the series of deposits produce base-poor, acidic soils.

The drainage pattern is determined largely by the three main drainage basins into which surface water flows. To the west, the broad valley of the River Avon is fed by six streams flowing westwards from the New Forest including Black Gutter/Ditchend Brook, Latchmore Brook, Dockens Water and Linford Brook. To the east, two further streams, Bartley Water and Cadnam River flow eastwards to the River Test and the upper reaches of the Southampton Water. To the south, a further three rivers flow into the Solent; the Lymington River, Beaulieu River and Avon Water. The clay strata store relatively little water and lead to very rapid run off after rainfall and only small groundwater flows to the rivers in the summer months. Consequently, the New Forest streams are characterised by very high winter flood flows and very low summer flows.

The New Forest is of considerable importance in the national context for its seven Geological Conservation Review Sites, which demonstrate aspects of the terrace gravels of the former Solent River and their associated Palaeolithic archaeology, as well as illustrating the evolution of more recent fluvial systems.

Habitats and mosaics

The SAC supports a complex mosaic of habitats formerly common in lowland western Europe but now rare and fragmented. The major components are the extensive wet and dry heathlands with their rich valley mires and associated wet and dry grasslands, the ancient pasture and enclosed woodlands, the network of clean rivers and streams and frequent permanent and temporary ponds. Outstanding examples of 13 habitats of European interest

are represented together with two Priority Habitat types, namely bog woodland and riverine woodland.

The existence of these habitats on such an extensive scale, fluctuating naturally over time with each other, creates an ecosystem of unparalleled importance in north-western Europe. While for convenience, each habitat is described separately, the existence of this dynamic habitat mosaic is of fundamental importance in creating enormous niche separation for exploitation by a vast suite of plants and animals of nature conservation importance.

Woodland habitats

The pasture woodlands extend to some 4,430ha (excluding riverine and bog woodland), comprising some 3,100ha of old growth woodland and 1,330ha of more recent secondary expansion. The principal tree species are beech and oak in varying proportions, with holly dominating the shrub layer. Several distinctive vegetation community types may be recognised depending both upon environmental factors such as soil nutrient and base status and human interventions both past and more recent. There is great structural diversity evident in these woodlands, with a complete range of tree age classes from saplings to mature, senile and dead standing and fallen trees, together with a wide range of tree densities from closed high canopy forest to open stands with extensive heathland glades, to a more open parkland-like structure. The oldest generation of trees still standing are oaks and beeches of early 17th century origin, many of which are pollarded. The main younger generations have arisen since about the mid-19th century, but tree regeneration is a continual process and may be frequently observed in pockets of scrub and fallen dead wood where protection from livestock grazing is secured, as well as in secondary spread of scrub and woodland onto adjacent heathland habitats.

Of the 3,100ha of old-growth pasture woodland some 2,520ha conforms to the Qualifying Feature Annex I habitats of *Atlantic acidophilous beech* (2,000ha), *Old acidophilous oak* (120ha) and *Asperulo-Fagetum beech woods* (400ha). The remainder comprises more mesotrophic, herb-rich oak woodland which has no Qualifying Feature equivalent.

The riverine woodlands comprise those floodplain woodland communities which, where not damaged by over-deepening of drainage channels, flood seasonally as water levels rise along meandering natural flood channels. Two communities are recognisable, the first occurring on mineral soils dominated by oak and ash with a rich shrub layer and one of the richest ground floras of all Britain’s lowland woods. The second is characterised by alder dominance in areas where peat accumulates in old channels and where springs arise in the floodplain. Common associates are ash and oak over a typical wetland ground flora. Many of these alder stands have evidently been subject to former coppice management.

There are around 212ha of old-growth riverine woodland in the New Forest which may be accommodated within the Qualifying Feature Annex I Priority Habitat *Alluvial forests with alder and ash.*

Bog woodland occurs on peat in which there is a significant component of bog species in the ground flora. Two main types are apparent, the sallow carrs, a feature of the acid headwaters and mires characterised by a significant *Sphagnum* moss component in the ground flora, giving way to alder carr on richer soils in valleys on swampy ground, where sphagna are replaced by tussock sedge. There is an estimated 250ha of bog woodland in the New Forest, of which about 33ha is old-growth sallow carr referable to the Qualifying Feature Annex I Priority Habitat *Bog woodland*.

In addition to the pasture woodlands described above the SAC contains enclosed woodlands which are not subject to livestock grazing. Principal localities are at Whiteparish Common, Loosehanger Wood, Langley Wood and Franchises Wood in the north of the SAC in Wiltshire as well as at Roydon Wood in the south of the Forest in Hampshire. Each support some or all of the plant communities referable to the Qualifying Feature Annex I habitats referred to above though they may vary considerably in gross appearance and detailed species composition as a result of differing woodland management systems (coppice or high forest) in the absence of livestock grazing. Former wood pasture stands at Roydon Wood were returned to livestock grazing in the early 2000s to restore favourable condition.

The Inclosures on the Crown Lands (some 8,536ha) are relatively recent forestry plantations on former heathland or ancient woodland sites. Tree species composition varies enormously but oak and beech are favoured on richer soils and conifers on heathland soils. Extensive manipulation of the underlying soils, drainage and vegetation has occurred, while remnants of semi-natural vegetation may or may not be discernible, depending upon the density of planting and other interventions.

Where recognisable remnant plant communities contribute to heathland and woodland Qualifying Feature Annex I habitats. Particularly significant in this regard are the 400ha of pasture, riverine and bog woodland communities which were incorporated within 18th and 19th century Statutory Inclosures.

The Statutory Inclosures (7,104ha) were enclosed under specific Acts of Parliament. They are free of Rights of Common only so long as they remain fenced—and at least 12% must remain unenclosed at any one time. Some of the oldest broadleaved stands are beginning to develop a significant nature conservation interest particularly where they were planted on ancient woodland sites.

The Verderers' Inclosures (814ha) were enclosed by agreement with the Verderers in the

late 1950s on the understanding that they would be returned to the Open Forest after a limited time span. They were largely planted with conifers on heathland sites. Consequently, their nature conservation value was restricted to surviving remnant heath and mire communities and the very high potential for heathland restoration following conifer removal. In the last 20 years, much of this has been restored to heathland and is subject to Open Forest management.

In addition to the Statutory and Verderers' Inclosures there are 494ha of Crown freehold woodland, most of which derive from the old Crown manor of Lyndhurst, as well as a further 198ha leased from adjoining estates. They contain a mix of broadleaf and conifer plantations.

Woodland flora and fauna

The semi-natural woodland communities described above support an outstanding flora and fauna and the forestry Inclosures have enormous potential in this regard. Of 18 species of native bat, 11 have been recently recorded in the New Forest woodlands, including Barbastelle and Bechstein's bat. Wood pasture alone supports an exceptionally rich breeding bird fauna including species specialising in old trees rich in crevices and rot holes, such as redstart and woodland floor specialists such as wood warbler. Up to two pairs of honey buzzard regularly breed in woodland in the New Forest representing some 2% of the entire UK population of this Annex I Birds Directive species.

Among the invertebrates, some 276 species of conservation concern are recorded from the wealth of habitats present in the woodlands. Of these a large number are saproxylic species for which a plentiful supply of fallen and standing deadwood (often associated with living trees), of all sizes and stages of decay is essential. Beetles, flies and moths exploit a range of habitat niches within this material and may feed on the wood itself, or on fungal associations living on the deadwood, or nutrient-rich sap resulting from damage to bark or from internal damage or be predatory on other saproxylic invertebrates living in and on the dead wood.

Of 56 species of butterfly present in the UK, 33 have been recorded in the New Forest since 1970. However, while some species are maintaining their populations, the woodland species in particular have experienced significant declines in recent decades. Of 17 species of conservation concern recorded in the New Forest since 1980, high brown fritillary is now extinct and Duke of Burgundy is now only recorded from Langley Wood, while two are failed reintroductions at Roydon Wood (marsh fritillary and heath fritillary). Of the remainder, most of the woodland species are struggling. The likely reasons for this continuing decline in butterflies principally relate to the incursion of livestock into the forestry Inclosures from about 1960 onwards, together with habitat losses through intensive modern silvicultural operations, especially fragmentation of broadleaf habitats by coniferisation. However, the

potential for management changes in the forestry Inclosures to lead to significant recovery of key species is very high. Those which could potentially benefit in the coming years as a result of implementation of the Forest Design Plans are white admiral, purple emperor, Duke of Burgundy, pearl-bordered fritillary, small pearl-bordered fritillary, high brown fritillary and silver-washed fritillary.

While the woodlands do not support many vascular plant species of national conservation concern, they do nonetheless have rich floras of characteristic species. Of 100 species on the Ancient Woodland Vascular Plant Indicator List (Rose, 1999), 78 have been recorded from the Crown Lands and 71 from Roydon Wood. These are very high totals. In the Crown Lands much has been made of the supposed impoverishment of woodland plants in pasture woodlands because of livestock grazing. This is not supported by ground survey; all but four species are present. Indeed, floras of grazed and ungrazed woodlands are very similar when woods on similar soils are compared, though the frequency of individual species can be very different.

A total of 350 lichen species have been recorded from the pasture woodlands, of which around a third are of conservation concern. The majority are species associated with old growth (i.e. woodland continuity greater than 200 years), a habitat of greatly diminished distribution elsewhere in north-west Europe. The bryophyte flora (mosses and liverworts) is the richest in lowland Britain, the species of interest all highly dependent upon livestock grazing to suppress competitive vegetation growth.

A total of over 2,700 species of fungi have been recorded in the New Forest. Some 71 species recorded are of conservation concern, of which 62 are woodland species associated either with standing or fallen old trees or whose fruiting bodies appear on the ground, though they have mycorrhizal links to trees.

Heathland habitats

New Forest heathland comprises extensive dry and wet heaths and associated valley mires, streams, ponds, temporary pools, dry and wet grasslands. The dry heath vegetation communities are separated by a soil moisture and nutrient gradient. Six distinctive subcommunities are recognisable along this continuum, ranging from the driest heather *Calluna vulgaris* dominated stands on the poorest soils, through those of slightly higher moisture and nutrient status to those too wet to support bell heather *Erica cinerea,* but not wet enough to support *Sphagnum* mosses and wet heath communities. The New Forest is unique in supporting a very wide band of intermediate vegetation (commonly called humid heath) which occupies the zone between the dry heath communities and wet heath. It is characterised by the presence of heather, cross-leaved heath *Erica tetralix*, purple moor-grass *Molinia caerulea* and the moss *Leucobryum glaucum*, in the absence of both bell

heather and *Sphagnum* mosses. On heathlands elsewhere, where the clay content of soils is less, this ‘humid heath’ zone is much narrower and the separation between dry and wet heath is very sharp. There are around 7,600ha of dry heath communities conforming to the Qualifying Feature Annex I habitat *European dry heaths* (this does not include additional open habitats restored from Inclosure woodlands currently estimated to be 876ha).

There are three wet heath vegetation subcommunities defined by soil moisture, nutrient and base status but which are additionally profoundly influenced by prescribed burning and grazing. Soils are too dry to sustain the large peat-building sphagna associated with mires, but too wet to support bell heather. Heather never gains the dominance that it reaches in late-successional stages following burning on dry heaths. Wet heath communities occur on nutrient-poor mineral soils or very shallow peats that are at least seasonally waterlogged but may be surface dry in summer.

The first wet heath subcommunity is characterised by the presence of heather, cross-leaved heath and purple moor-grass in varying amounts with deergrass *Trichophorum cespitosum* and heath rush *Juncus squarrosus* with various small sphagna species. This is the most extensive form of wet heath occupying around 50% of the total coverage of 2,100ha. The second subcommunity is more tussocky and considerably more species-rich as a consequence of more base-rich underlying soils. Species such as devil’s-bit scabious *Succisa pratensis*, meadow thistle *Cirsium dissectum*, saw-wort *Serratula tinctoria* and the nationally scarce marsh gentian *Gentiana pneumonanthe* occur. These first two wet heath subcommunities are referable to the Qualifying Feature Annex I habitat *Northern Atlantic wet heaths with Erica tetralix.*

The third wet heath subcommunity is characterised by a reduced cover of heather, cross leaved heath and purple moor-grass and a more extensive *Sphagnum* carpet. Wetter hollows support sundews *Drosera* spp. and bare peat is colonised by the local brown-beaked sedge *Rhynchospora fusca.* This subcommunity is referable to the Qualifying Feature Annex I habitat *Depressions on peat substrates (Rhynchosporion)* and comprises around 210ha or 10% of the total wet heath vegetation.

The New Forest mires comprise a suite of communities which are described under the generic headings of *‘Valley Bogs’, ‘Bog Pools’, ‘Soakways’, ‘Poor Fen’, ‘Moorgrass Mires’, ‘Marl Flushes’* and *‘Marl Swamps’* (Sanderson, 1998). Mire is a generic term used here to encompass the variation in vegetation which in the New Forest is really a combination of bog and fen in the classic sense. Bogs are typically rain-fed, mineral and nutrient-poor and acidic. Fens are groundwater fed, have a higher nutrient status (mesotrophic to eutrophic) and are generally neutral or alkaline. New Forest mires have elements which are typical of both bogs and fens. The variation in vegetation composition in New Forest mires is attributable to a number of related factors. The most important are acidity determined by underlying soils, hydrology, nutrient status and management—particularly grazing and

burning pressure. The structural variation is very wide and each mire system is unique.

Mires occur as either seepage step mires or valley mires. Valley mires form in valley bottoms with low hydraulic gradients and impermeable subsoils, allowing peat accumulation. Wide, shallow valleys with slight gradients support extensive mires; narrow, steep valleys support smaller, more localised mires. The distribution of the various plant community types is in part related to water chemistry and nutrient status—this in turn is dependent upon the base status of the parent material from which the soil water derives in the New Forest ground water fed valley mires. Hence, the central flows of valley mires which receive water from the Headon Beds may be neutral or slightly alkaline. Those fed from sands and gravels are acidic.

This effect is most concentrated along the axis of flow and increases downstream. In addition, this produces a further gradient of declining nutrient status and increasing acidity across valley mires from the central axis. Vegetation communities develop along these gradients, classically from enriched fen and carr along the axis to increasingly acidic *Sphagnum* bog communities peripherally.

Seepage steps form on valley sides where ground water concentrates above the junction between a permeable sandstone and an underlying impermeable clay. Subsequent erosion produces a characteristic profile in which there is a steep scarp slope above the seepage and a zone of slumped material below it, the mire forming in water retentive hollows of the undulating slope.

'Valley Bogs' are the most extensive mire community type, occurring in both valley and seepage step localities on permanently waterlogged, nutrient-poor acidic peats. They are typically characterised by extensive and luxuriant peat forming *Sphagnum* mosses with accompanying bog species such as bog asphodel *Narthecium ossifragum*, cotton grass *Eriophorum angustifolium* and white-beak sedge *Rhynchospora alba*. Many of the larger valley bogs support *'Bog Pool'* communities which may in turn support some very local species including lesser bladderwort *Utricularia minor* and the insectivorous great sundew *Drosera anglica*. A third very distinctive mire community, *'Soakways'* exists along natural drainage runnels of valley bogs which are dominated by marsh St John's wort *Hypericum elodes* and bog pondweed *Potamogeton polygonifolius*. *'Poor Fen'* communities develop where nutrient status is slightly elevated. The most acid loving species are absent and are replaced by typical poor fen associates such as star sedge *Carex echinata* and marsh willowherb *Epilobium palustre*.

Where water movement is higher and grazing pressure reduced purple moor-grass can dominate forming the fifth mire community *'Moor-grass Mires'*. These are floristically impoverished and it should be noted that all New Forest mires with sufficient water flow have the capacity to degenerate to moor-grass mire if grazing were reduced sufficiently.

Equally, moor-grass mires will revert to more floristically-rich communities if grazing levels (and maybe some prescribed burning) increase. None of the above acidic mire communities have equivalents in the Corine classification and hence the Habitat Directive.

'Marl Flushes' occur on seepages and highly flushed areas in valley mires with shallow peat but sufficient base enrichment to support brown mosses and the more base-demanding vascular plants. The most striking are those found in seepage step mires on marl (lime-rich clay) producing water so base-rich that tufa is deposited on the mosses. However, less strongly lime-enriched flushes (pH 6-6.5) without tufa deposition are more frequent. The former is referable to the Qualifying Feature Annex I habitat *Alkaline fen.*

Finally, *'Marl Swamps'*, are generally confined to areas within valley mires where artesian sources of base-rich water produce very wet swampy conditions. They have been particularly adversely affected by drainage and Inclosure for forestry, as well as carr invasion on the Open Forest. Marl swamps are referable to the Qualifying Feature Annex I habitat *Transition mires.* The extent of the full range of this feature in the New Forest is not currently known.

The New Forest dry grasslands comprise a suite of communities which are described under the generic headings of '*Parched Acid Grassland', 'Heathy Acid Grassland', 'Moist Acid Grassland', 'Neutral Greens'* and '*Herb-rich Bracken Grassland'* (Sanderson, 1998). There is no Qualifying Feature equivalent to the dry grasslands. Given a high and relatively uniform grazing pressure, soil fertility and soil moisture retention are the main factors determining the distribution of the various dry grassland communities.

'*Parched Acid Grassland'* is dominated by fine-leaved grasses with a high cover of mosses and lichens, in an open sward which becomes parched and brown in late summer. Stands may be species-rich and the presence of sheep's sorrel *Rumex acetosella* and early hair-grass *Aira praecox* are especially diagnostic. Lime-enriched stands are dominant wherever cultivation has been carried out or where broken wartime concrete survives in the soil—these are the main swards on the dry re-seeded areas. Otherwise, parched acid grasslands tend to be found as small pockets on areas of dry, brown earths, sometimes on sites of obvious prior disturbance such as gravel pits, but often simply on patches of richer soil. Associated vegetation is typically heath but the community can even occur in larger pasture woodlands.

'*Heathy Acid Grasslands'* are dominated by bristle bent *Agrostis curtisii* and purple moor-grass and are generally species-poor and grade into dry heath as heather cover increases.

'*Moist Acid Grassland*' is species-poor occurring locally as small strips between parched acid grassland and wet lawns, but also a distinctive community of damp pasture woodland glades. It is characterised by the presence of fine leaved grasses in association with heath

bedstraw *Galium saxatile*, tormentil *Potentilla erecta* and the moss *Rhytidiadelphus sqarrosus*. The species characteristic of the more species-rich parched acid grasslands is absent.

'Neutral Greens' are dry to moist grasslands characterised by a species-poor, grass dominated sward of common bent *Agrostis canina* and red fescue *Festuca rubra*, but with crested dog's-tail *Cynosurus cristatus*, rye grass *Lolium perenne*, daisy *Bellis perenne* and red clover *Trifolium pratense* as diagnostic species. They are of note due to their distinctive mats of chamomile *Chamaemelum nobile,* a nationally scarce and declining species.

'Herb-rich Bracken Grassland' contains bracken in a distinctive community on moist soils within a species-rich mosaic of grassland and woodland herbs. It is characterised by the presence of grassland species such as devil's-bit scabious, betony *Stachys officinalis*, saw-wort and lesser-butterfly orchid *Platanthera bifolia* in a mosaic with woodland ground flora species, particularly bluebell *Hyacinthoides non-scripta*, wood anemone *Anemone nemorosa* and common dog violet *Viola canina.* This is the principal habitat of wild gladioli *Gladiolus illyricus*, a nationally rare species listed in Schedule 8 of the Wildlife and Countryside Act, which is confined to the New Forest in Britain.

The New Forest wet grasslands (known colloquially as wet lawns) comprise a suite of plant communities confined to impermeable or slowly permeable clays, which are waterlogged in the winter but which dry out to some extent in the summer. They occur both on flushed soils on valley slopes and on floodplains of forest rivers and streams. They are generally tightly grazed swards characterised by the presence of velvet bent *Agrostis capillaris* and sedges, along with species typical of wet acid grasslands especially purple moor-grass, devil's-bit scabious, creeping willow *Salix repens* and meadow thistle. Extensive carpets of bog pimpernel *Anagallis tenella* are seasonally prominent. Where soil water retention is highest, or around flushes, marsh pennywort *Hydrocotyle vulgaris*, sharp-flowered rush *Juncus acutiflorus* and marsh St John's wort are abundant. The more acidic sites support *Sphagnum* lawns and an increasing heathy element with cross-leaved heath.

Wet grasslands are profoundly affected by stocking regimes, soil moisture retention and soil fertility which are key factors in defining vegetation structure, community type and distribution. There are two main types, firstly the enriched floodplain rush pasture characterised by tightly grazed swards with abundant sedges and frequent sneezewort *Achillea ptarmica*, marsh bedstraw *Galium palustre*, marsh valerian *Valeriana dioica* and cuckoo flower *Cardamine pratensis* but with little evidence of the more usual rush domination which occurs on similar less tightly grazed rush pastures off the New Forest. The second wet grassland type is the species-rich fen meadow community characterised by increased purple moor-grass, meadow thistle and the presence of such wet acid grassland species as bog pimpernel, lousewort *Pedicularis sylvatica*, devil's-bit scabious and bog asphodel. Fen meadows are referable to the Qualifying Feature Annex I habitat *Molinia*

meadows on chalk and clay.

The New Forest supports a range of distinctive vegetation communities restricted to water-filled shallow depressions on poorly drained soils which dry out temporarily during the summer months. Sanderson (1998) has derived a provisional classification of these temporary ponds which describes five distinct vegetation community types: the *'spike-rush-purple moor-grass community',* the *'lesser marshwort-floating club-rush-pillwort community',* the *'creeping bent-marsh foxtail-knotweed community',* the *'floating sweet-grass community'* and the *'pool edge assemblages'.* Given a relatively high grazing pressure, the main factors in determining the distribution of the various temporary pond communities across the Forest are base status of the water (derived from the underlying soils), nutrient status and input, as well as the length of submergence.

The *'spike-rush-purple moor-grass community'* is characterised by grazed swards of spike rush *Eleocharis palustris* and purple moor-grass often with carpets of *Sphagnum* and is typically found in pans and runnels in wet heath where fairly acid, nutrient-poor water collects, but which is not sufficiently acidic or nutrient-poor to support typical bog pool communities. The *'lesser marshwort-floating club-rush-pillwort community'* supports a mixed vegetation characterised by the presence of lesser marshwort *Apium inundatum* and floating club-rush *Eleogiton fluitans* and the nationally rare, grass-like fern pillwort *Pilularia globulifera*. Typical associates of the well-grazed Forest temporary pond communities include the two nationally rare species slender marsh-bedstraw *Galium constrictum* and Hampshire purslane *Ludwigia palustris*, as well as shoreweed *Littorella uniflora*. Generally found in temporary ponds with less acidic but nutrient-poor water, typically in depressions within wet grassland vegetation. These first two temporary pond communities are referable to the Qualifying Feature Annex I habitat *Oligotrophic waters containing very few minerals of sandy plains: Littorelletalia uniflorae*.

The *'creeping bent-marsh foxtail-knotweed community'* is a variable community ranging from grassy to herb dominated communities with the grasses creeping bent *Agrostis stolonifera*, marsh foxtail *Alopecurus geniculatus* and occasionally reed sweet-grass *Glyceria* spp., with the ruderal herbs marsh cudweed *Gnaphalium uliginosum*, water-pepper *Persicaria hydropiper,* small water-pepper *P. Minor*, redshank *P. maculosa*, trifid bur-marigold *Bidens tripartita* and silverweed *Potentilla anserina*. These temporary ponds are notable for the presence of the nationally scarce mudwort *Limosella aquatica*, as well as the nationally rare species, pennyroyal *Mentha pulegium* and small fleabane *Pulicaria vulgaris.* These communities are associated with higher nutrient status and fairly neutral pH, in situations where heavy grazing results in poaching and the accumulation of dung. They are typically found within neutral greens and in water-retaining depressions in parched acid grasslands.

The *'floating sweet-grass community'* is dominated by reed sweet-grass *Glyceria fluitans* in

flood channels in floodplain wet grasslands. While grazing reduces the dominance of reed sweet-grass they are relatively species-poor stands compared to the other community types, though notable on occasion for the presence of the nationally rare slender marsh-bedstraw.

The *'pool edge assemblages'* are communities on the edge of large temporary ponds, shallow ephemeral pools and poached damp hollows in grassland which support a number of specialist species in a zone with toad rush *Juncus bufonius*. These include the two nationally scarce species coral necklace *Illecebrum verticillatum* and yellow centaury *Cicendia filiformis*, often in association with allseed *Radiola linoides* and chaffweed *Anagallis minima*. The pool edge assemblages are referable to the Qualifying Feature Annex I habitat *Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and Nanojuncetea.*

Heavy grazing pressure is of prime importance in the maintenance of the outstanding flora of these temporary pond communities in the New Forest. It maintains an open habitat, controlling scrub ingress and stock trample the surface. Commoners' animals also transport seed in their hooves from pond to pond widely across areas where suitable habitat exists.

There are a number of permanent ponds in the New Forest of varying acidity and nutrient status. Hatchet Pond is notable for its extensive population of shoreweed and associated flora including the nationally scarce six-stamened waterwort *Elatine hexandra*. This together with the distinctive marginal amphibious vegetation communities are referable to the Qualifying Feature Annex I habitat *Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and Nanojuncetea.*

The New Forest streams are a geographically isolated type with no equivalent in lowland England. The largest is the Lymington River with its two contrasting tributaries the Ober Water and Highland Water. As the streams flow downstream, they become progressively less acidic and nutrient-poor and consequently exhibit a unique vegetation succession from acid communities at the source akin to mountainous upland regions, through richer stream floras as they pass through open grassland and woodland communities, to more typical enriched neutral river plant communities in the lower reaches.

Heathland flora and fauna

The heathland communities described above support an outstanding flora and fauna of great diversity and importance. Of particular significance among a rich bird community are the species for which the Forest is designated a Special Protection Area under the EU Birds Directive. These are Dartford warbler, nightjar and woodlark all of which have breeding populations of European significance and hen harrier which overwinters in numbers of European significance. The ponds and streams support five native amphibians including

great crested newt (an Annex II species for which the SAC is specially designated under the Habitats Directive) and all six native reptiles—though only smooth snake and sand lizard are strictly confined to heathland habitats.

Around 270 invertebrate species of conservation concern are accommodated on the New Forest heathland habitats. This includes 47 species of butterfly and moth of which silver-studded blue butterfly is probably the most widespread and easily recognised. Among the 27 species of dragonfly and damselfly which regularly breed in the Forest wet heaths, seepages, ponds, ditches and streams are five of conservation concern including southern damselfly an Annex II species for which the SAC is specially designated under the Habitats Directive. Of 109 species of beetle of conservation concern a large percentage are associated with the Forest open wetland habitats while others are dependent upon the animal dung deposited by livestock. 40 of the 43 species of ants, wasps and bees of conservation concern are dependent upon heathland habitats, many being especially associated with dry heath containing south-facing bare sandy slopes. Black bog ant has its national stronghold in the New Forest mires, maintained by the essential grazing and prescribed burning management regimes. There are 100 fly species of conservation concern associated with heathland habitats, exploiting all available niches from mires to dry heath, grassland, livestock dung and bare ground. Among the 22 species of grasshopper and cricket which occur in the New Forest are 12 of conservation concern, eight of which are associated with heathland habitats, including large marsh grasshopper.

Two species of *Crustacea* are of conservation concern, both dependent upon predator-free temporary ponds in the grazed heathland matrix. The tadpole shrimp is restricted almost entirely to the New Forest in the UK where it is present in just two ephemeral ponds. Meanwhile fairy shrimp lays long-lived, drought-resistant eggs which remain in the pond bed during dry spells, hatching some hours after wetting.

Of 39 species of vascular plant of conservation concern recorded in the New Forest, 36 are associated with heathland habitats. Some have been referred to in the plant community descriptions above. Of particular note in this regard are the dry grasslands and temporary pond communities. Parched acid grassland is the richest dry grassland type with several nationally scarce species including mossy stonecrop *Crassula tillaea*, smooth cat's-ear *Hypochaeris glabra* and hairy bird's-foot-trefoil *Lotus subbiflorus*. Heathy acid grassland supports heath lobelia *Lobelia urens* and pale dog-violet *Viola lactea*.

Lichens are a significant component of heathland habitats in the widest sense. A total of 183 species have been recorded from heathland habitats including five of conservation concern. The lichen flora of the dry and wet heaths is particularly well developed and includes many species such as *Cladonia strepsilis* and *Pycnothelia papillaria* which have seriously declined in the lowlands. It is undoubtedly the best-preserved heathland lichen flora in the lowlands. The heathland bryophytes (mosses and liverworts) are found in a wide

variety of habitats. Two species of particular importance are the nationally scarce mosses *Hypnum imponens* and *Dicranum spurium*, light demanding species which share heavily grazed humid and drier heath with rich lichen floras. The New Forest probably supports the majority of the English populations of these species.

Another distinctive group are the tiny liverworts that are epiphytic on *Sphagnum* in valley bogs. These include the nationally scarce *Cephalozia macrostachya*, *Cephalozia pleniceps* and *Cephaloziella elachista*. This epiphytic liverwort flora, including other less threatened species, is otherwise only found in undamaged blanket and raised bogs.

Another major group is annual species of liverwort of ephemeral ponds and bare seasonally wet soils that includes the nationally scarce *Fossombronia foveolata, Fossombronia incurva, Riccia subbifurca* and *Sphaerocarpos michellii.* Deeper, more base-enriched, ephemeral ponds in marl pits also support a rich moss flora related to that of alkaline fens that includes the nationally scarce species *Drepanocladus sendtneri* and *Campylium elodes.* The latter flora is highly threatened by scrub invasion. Two species associated with the transition mires in the Holmsley area, *Philonotis caespitosa* and *Hamatocaulis (Drepanocladus*) *vernicosus*, may have been lost to the spread of scrub.

Among the fungi, most of the species of nature conservation concern are woodland species, with only nine heathland and grassland species recorded. These include species of acid grassland and species that are mycorrhizal on creeping willow. The best-known heathland species is nail fungus *Poronia punctata*, which is a specialist confined to dung from ponies grazing acidic rough pastures. It is found on dung deposited on acid grassland and heath. It has recently been rediscovered in Dorset (Cox and Pickess, 1999) and the Breckland heaths of Norfolk (2012). However, the main populations are on Hampshire heathlands and its strongest and most extensive populations lie within the New Forest.

Technical description

Location

The New Forest SAC is situated on the south coast of England in the counties of Hampshire and Wiltshire. It lies immediately to the north of the Solent, between the major conurbations of Bournemouth to the west and Southampton to the east. The extensive chalk landscapes of Salisbury Plain and the west Wiltshire Downs lie to the north. The SAC comprises seven SSSIs which together cover more than 29,000ha. The component sites are The New Forest SSSI and Roydon Wood SSSI in Hampshire as well as Langley Wood and Homan's Copse SSSI, Landford Bog SSSI, Loosehanger Copse and Meadows SSSI

and Whiteparish Common SSSI in Wiltshire. (While the SAC contains most of the Lymington River SSSI headwaters, the riverine features themselves have not been selected for SAC designation in their own right but are within the New Forest SPA and New Forest Ramsar site.)

Tenure

Over 90% of the SAC is Crown Land managed by Forestry England, comprising most of the unenclosed land and the woodland Inclosures. There are however around 55 private owners and occupiers managing significant areas of SAC habitats. Other significant landowners and managers include the National Trust (Bramshaw Commons, Rockford and Ibsley Commons, Hightown Common and Hale Purlieu), Hampshire Wildlife Trust (Roydon Wood), Hampshire County Council (Hyde and Gorley and part of Rockford and Ibsley Commons) and Natural England (Langley Wood) and most recently the Royal Society for the Protection of Birds which has purchased Franchises Wood. The Crown Lands, Commons and Manorial Wastes are bounded by the New Forest 'perambulation' which encloses some 37,907ha. Historically the perambulation was the limit of the area within which Forest Law had jurisdiction and it was considerably larger in extent than today. Currently it delimits the area within which the New Forest Verderers apply their by-laws for the control and health of stock depastured on the commons and within which the animals are contained by cattle grids and fencing.

Map coverage

Ordnance Survey Landranger Series, Numbers 196, 195, 185, 184. 1:50,000 Scale

Ordnance Survey Explorer OL Series, Number 22 *New Forest*. 1: 25,000 Scale

Ordnance Survey 1: 10,000 series: SU22SW, SU22SE, SU11NE, SU21NW, SU21NE, SU31NW, SU11SE, SU21SW, SU21SE, SU31SW, SU10NE, SU20NW, SU20NE, SU30NW, SU30NE, SU40NW, SU10SE, SU20SW, SU20SE, SU30SW, SU30SE, SU40SW, SZ19NE, SZ29NW, SZ29NE, SZ39NW, SZ39NE, SZ29SW, SZ29SE.

Ordnance Survey detailed digital mapping data (nominal scale 1:1250/1:2500):
OS MasterMap Topography Layer and other layers.

Geological Maps: British Geological Survey:

2004: 1:50,000 Number 314 Ringwood solid and drift

1987: 1:50,000 Number 315 Southampton solid and drift

1991: 1:50,000 Number 329 Bournemouth solid and drift

1997: 1:50,000 Number 330 Lymington drift

Aerial photograph coverage

Aerial photograph coverage for the New Forest SAC is given in Table 1 (Cox and Reeves, 2000; Ninth Centenary Trust).

Table 1: Coverage of aerial photographs of the New Forest area

Date	Origin	Scale	View	Coverage	HolderFormatNotes
1940/43	Luftwaffe	1:10,000	Plan	Majority	F.E.BandW (and negatives for 1940)
1446	R.A.F.	1:10,000	Plan	Full	F.E.BandW
1946	R.A.F.	1:10,000	Plan	Full	E.N.BandW
1960/62	Univ. of Cambridge	Medium level	Oblique	Part	E.N.BandW 5”x5” prints
c.1960s		1:10,000	Plan	S.W.	F.E.BandW
1967	Meridian Air maps Ltd.	1:10,000	Plan	Full	E.N.BandW
1968/9		Low level	Oblique	Camping areas	F.E.BandW 5”x5” prints
1971		1:10,000	Plan	Full	H.C.C.BandW
1972/3 F.C.		Low level	Oblique	Rec. areas	N.F.M.BandW 6”x8” prints
1972/3 F.C.		Low level	Oblique	Rec. areas	F.E.BandW 6”x8” prints (1 box-see N.F.M.)
1978	MAFF	1:3,950	Plan	Roundhill/ Dilton area	F.E.BandW
1982		1:10,000	Plan	Full	F.E.BandW
1984	Meridian Airmaps Ltd.	1:10,000	Plan	Full	F.E.BandW
1984	GCA	1:10,000	Plan	N.W. part	BandW
1984		1:10,000	Plan	Full	H.C.C.BandW
1987	MAFF	1:10,000	Plan	Holmesley Bog-Hursthill Inc.	F.E. BandW1 flight line.
1991	Geonex	1:10,000	Plan	Full	F.E. Colour
1991	Geonex	1:10,000	Plan	Full	E.N. Colour
1991	Geonex	1:10,000	Plan	Full	H.C.C. Colour

Date	Origin	Scale	View	Coverage	HolderFormatNotes
1995	BKS Survey	1:10,000	Plan	Full	F.E. Colour 18“x18“ prints
1996	BKG	1:20,000	Plan	Full	H.C.C. Colour

More recent aerial imagery is available for public view with online access through, for example, MAGIC (Defra) or Google Maps.

LIDAR coverage

Airbourne LIDAR (Light Detection and Ranging) measures the height of the ground surface and other features in large areas of landscape with a very high resolution and accuracy. This information was previously unavailable except through labour-intensive field survey or photogrammetry. The whole of the SAC has been flown in order to generate the LIDAR data. This information and its analysis is available through the New Forest National Park Authority.

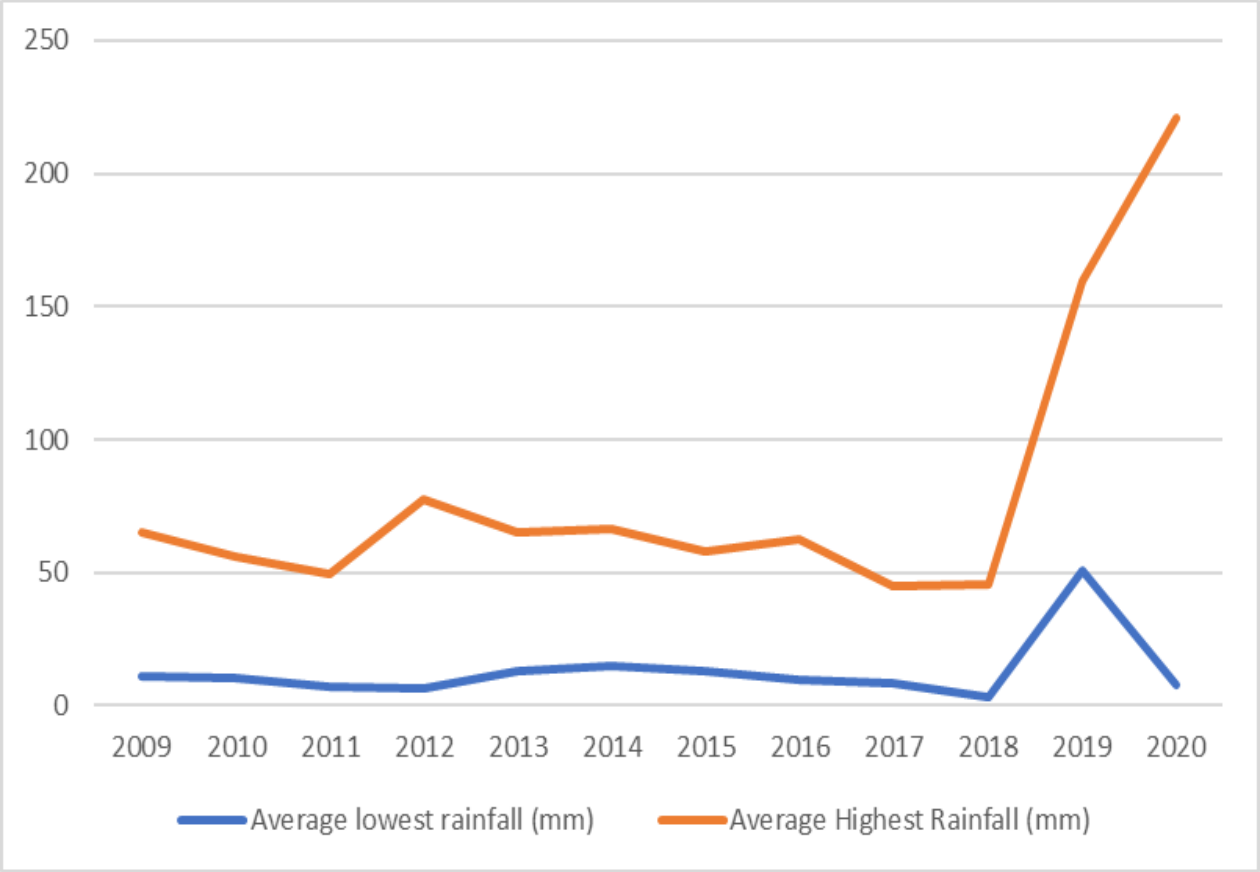
Alternatively, Environment Agency National LIDAR Programme data provides 1m spatial resolution data, from 2020/2021, published through the DEFRA Data Services Portal.

Climate

The New Forest enjoys a favourable climate by British standards of warm summers and mild winters with variable rainfall, but generally avoiding the more extreme dry and cold conditions of further east and north.

Snow fall is rare and only the really severe winter of 1962-1963 saw the Forest snow and ice bound for nearly eight weeks (Tubbs, 1986). Frosts are common, but seldom does the night temperature fall below -9ºC. The climate is described as temperate; westerly winds bringing a succession of low and high-pressure systems leading to frequent variations of small amplitude in the weather, characterised as wet and mild. For the last 10 years the mean temperature of the coldest month is above -1ºC and below 9ºC (10-year average of 2.3ºC and 6.9ºC respectively), while the mean temperature of the warmest month is above 19ºC but below 22ºC. Rainfall occurs throughout the year and in the driest month is rarely less than 60mm (Webb, 1986). However, there is evidence that climate change may be having a significant effect on average temperatures and rainfall patterns in recent years and extreme weather events could become more frequent and intense. In the past two years, summer temperatures have exceeded 33ºC and frosts have become less common.

Figure A: Rainfall data from Lyndhurst Golf Club weather station



As illustrated in Figure A, rainfall data from the New Forest Golf Club (Lyndhurst-central New Forest) over the years 2009-2020 shows that the lowest average monthly rainfall was in 2018 with just 2.9mm. However, in 2019 this figure was 50.5mm which was significantly higher than in the remaining 11 years. The lowest average monthly rainfall over the 12 years was 12.94mm. If the 2019 anomaly is removed, then the lowest average monthly rainfall over the remaining 11 years becomes 9.5mm. These minima are significantly less than the 60mm noted by Webb in the 1980s.

Turning to the highest average monthly rainfall data there are significant peaks in 2019 of 159.6mm and in 2020 of 220.9mm. The highest average monthly rainfall over the 12 years 2009 to 2020 is 80.89mm. Future data will show if this is an increasing trend in rainfall extremes as predicted with anthropogenic climate change. It could be early evidence of drier springs and wetter autumns and winters.

Geology

The New Forest lies in the north-central part of a broad and shallow chalk syncline, known as the Hampshire Basin, upon which sands and clays were deposited during the Tertiary period (65-one million years ago). This was subsequently overlain by a superficial covering of gravels and Brickearth deposited during the Pleistocene period (one million years ago).

More recent superficial material continues to be deposited in the form of river alluvium and peat. This sequence is summarised in the following table:

Table 2: Geology of the New Forest

Period	Epoch	Years before present	Deposits
Quaternary	Recent	25,000	Alluvium Peat
	Pleistocene	One million	Gravel Brickearth (50% fine sand, 30% silt, 20% clay)
Tertiary	Pliocene	12 million	No record
	Miocene	25 million	No record
	Oligocene	40 million	Osborne Beds Headon Beds (upper and middle)
	Eocene	60 million	Headon Beds (Lower) Barton Sands Barton Clay Bracklesham Beds Bagshot Beds Reading Beds and London Clays
	Palaeocene	70 million	
Cretaceous		135 million	Chalk

Tertiary sedimentation

The sedimentation events occurred in a variety of Tertiary environments including shallow seas, estuaries, brackish lagoons, as well as freshwater marshes and river deltas. These varied conditions resulted in the deposition during the Eocene epoch of a variety of sediment types including clays, clay marls and sands. Erosion of the recent overlying Quaternary deposits (see below) has exposed these underlying rocks in wide valleys and hollows. Many of these deposits are rich in fossils including molluscs, fish, reptiles, birds and early mammals. (For example, Studley Wood contains a site of national importance for its geological interest, featuring the only complete exposure of the Huntingbridge Formation of the Bracklesham Group, remarkable for its *Molluscan* faunas including corals, scaphoda, bivalves and gastropods.)

The New Forest strata tip gently southwards at about one to two degrees which is slightly greater than the descent in altitude in the Forest along the north-south gradient. This results in exposure of the Lower and oldest Tertiary beds in the north and the younger in the south. The Tertiary sequence can hence be broadly followed along a north-south gradient with the earliest Reading Beds and London Clays outcropping at the margin of the Chalk in the northern extremity of the Forest. (See Map A in Part 2: Appendix 1 for a bedrock map.) Southwards it is possible to observe successional exposures of Bagshot Sands,

Bracklesham Beds, Barton Sands and Barton Clays until further south the Oligocene Headon Beds overly the Eocene strata as a variety of clays and clay marl.

Quaternary sedimentation

The Tertiary sands and clays are partially masked by sheets of flint, gravel and Brickearth laid down under tundra conditions at the transitions between interglacial and glacial episodes during the Ice Age in the Pleistocene epoch of the Quaternary Period. Though much eroded, particularly in the north, extensive remnants of the gravel deposited by ancient river systems and Brickearth (wind deposited loess) survive as flat terraces. The gravels, derived as angular flints from the underlying chalk, can reach a maximum depth of 6.5m but are generally between 1-3m deep, while the Brickearth deposits may be up to 3m deep overlying gravel or infilling ancient channels (Tubbs, 1986).

The older river gravels have been much disturbed by freezing and thawing (cryoturbation), solifluction (slow downslope movement following thaws) and soil forming processes e.g. illuviation of clay (movement of clay down through the soil and accumulation at depth) through several warm and cold periods of the Ice Ages.

Soils

Ecologically it is the ability of the underlying rocks to transmit water and to form the basis of soils of various kinds that is important—this depends upon the morphology and chemistry of the principal deposits. The Eocene ‘Bagshot Beds’ (currently regarded as several separate sandy beds of the London clay) are coarse and porous materials which leach nutrients more readily than do fine clayey sediments. Soils derived from such material are acidic and nutrient poor. The finer clay-rich marine deposits such as the glauconitic Bracklesham clays and the later Barton clays are relatively base-rich and yield better soils (though the associated bands of sand produce impoverished soils). In the south the Oligocene Headon Beds yield base-rich clays and clay marl where not obscured by the extensive areas of Pleistocene gravel and Brickearth. Hence, the relative fertility of soils follows the same north-south gradient as the underlying strata with Forest soils generally becoming progressively less impoverished from north to south. This explains why there is a greater diversity in the flora in the south of the Forest on the more nutrient rich, less base-poor soils than on the more acid, nutrient-poor sands and gravels of the north.

The soils of the New Forest are highly complex. As such, this short summary can only be regarded as superficial. The Soil Survey of England and Wales has produced a classification of soils as *Soil Series*; distinctive individual soil types developed on specific parent materials and soil associations which are distinctive assemblages of soil series in identifiable landscape types (Jarvis et al, 1984). In the New Forest, Jarvis et al (1984) have

identified nine soil associations which are summarised in Table 3. The main soil types found in the New Forest, their characteristics and the principal vegetation/NVC community types which they support is given in Table 4.

Table 3: Soil associations within the New Forest (Jarvis et al, 1984)

Soil associations	Characteristics	Landscape
Wickham 3	Developed in thin drift of Tertiary loams and clays. Seasonally waterlogged stagnogleys dominate with Stagnogleyic Argillic Brown Earths in better drained areas and Typical Argillic Gley Soils where affected by ground water. Locally on driest areas and Raw Oligo-amorphous Peat Soils and associated humic soils in mires.	Dominates pasture woodland-heathland complexes in the east and centre and heathland valleys in higher terraces
Bolderwood	Developed on gravel terraces. Podzolic soils with seasonal waterlogging at depth, stagnogley-podzols dominate with better drained podzols (Paleo-argillic Podzols and Humo-ferric Podzols) on terrace edges small areas of Stagnogleys Typical Argillic Brown Earths and Raw Oligo-amorphous Peat Soils.	Dominates heathland on gravel terraces in north, west and south
Holidays Hill	Developed in Tertiary sands and clays. Podzols with seasonally waterlogged sub-soils stagnogley-podzols dominate with Humo-ferric Podzols on drier ground, stagnogleys on seasonally wet clays and locally extensive Typical Humic-sandy Gley Soils on low-lying ground affected by ground water. Small areas of Raw Oligo-amorphous Peat Soils occur in mires and Typical Argillic Gley Soils in river valleys.	Dominates heathland on Tertiary sands. Mainly northern commons and Matley area
Shirrell Heath 1	Developed in Barton Beds and terraced edges. Freely draining Humo-ferric Podzols dominate with wetter Stagnogley-podzols, Gley Podzols, Typical Humic-sandy Gley and Typical Argillic Gley Soils.	Localised dissected terrace edges in southwest of Forest
Southampton	Dry podzols with ancient red subsoils, Paleo-argillic Podzols, dominant. Humo-ferric Podzols and Stagnogley-podzols on terrace slopes	Small well drained terrace fragments on west of Forest
Bursledon	Loamy soils developed on inter-bedded sands and clays of the Bracklesham and Barton Beds. Stagnogleyic Argillic Brown Earths with seasonally waterlogged sub-soils dominate with more poorly drained	Pasture woodland and associated Inclosures in Mark Ash areas

Soil associations	Characteristics	Landscape
	Stagnogleys and Typical Argillic Gley Soils. Pockets of Holidays Hill Association soils on heaths	
Hurst	River terrace gravel affected by high ground water. Typical Argillic Gley Soils dominate with stagnogleys where alluvium thins over underlying clay	Low lying alluvial terraces in pasture woodland-heathland areas Natural England of Brockenhurst
Isleham 1	Developed in permeable sands in valley bottoms with very high-water tables. Typical Humic-sandy Gley Soils and Raw Oligo-amorphous Peat dominate with Typical Gley-podzols on the edges.	Wet sandy basins in the Cranes Moor area

Table 4: The main soil types found in the New Forest and the principal vegetation which they support

Soil type	Characteristics	Principal vegetation	Principal NVC type
Stagnogleys	Seasonally waterlogged soils with a clay subsoil. Waterlogging caused by surface water	Pasture woodlands and heathlands slopes and glades, wet heaths and wet lawns	W8, W14, W15, W11/10, W16, M24c, M25
Stagnogleyic Argillic Brown Earths	Similar to stagnogleys but better drained and waterlogging deeper in subsoil	Drier acid pasture woodlands, bracken and acid grassland	W14, W15, U20, U3
Argillic Brown Sand	Well drained sandy soils without waterlogging but clay accumulation at depth	Acid grasslands and bracken	U20, U3, U1
Typical Argillic Gley Soils	Permeable soils affected by seasonally high ground water	Wet heaths and wet lawns and riverine woodland on alluvium	M16, M24, M25, M23, W8.
Raw Oligo-amorphous Peat	Strongly acid peat accumulation	Mire dominated by valley bog vegetation and bog woodland	M21, M6, M29, W4

Soil type	Characteristics	Principal vegetation	Principal NVC type
Raw Eu-amorphous Peat	Less acid peat accumulation	Mainly carr but also some open mires and peaty riverine woodland	W5, W7, M29, M9, M10
Stagnogley-podzols and Typical Gley Podzols	Podzols with seasonal waterlogging in the subsoil	Humid heath	H2c and H3a
Humo-ferric Podzols and Paleo-argillic Podzols	Drier podzols	Dry heath	H2a and H3c
Typical Humic-sandy Gley Soils	Sandy soils affected ground water with thin peat accumulation	Wet heath	M16

Geomorphology and drainage patterns

The geomorphological history of the New Forest is described in Tubbs (1986), who also summarises Tuckfield's work on present day denudation and the contribution that artificial drainage has made to it. The New Forest is a landscape of eroded gravel terraces capped with flint gravel, Brickearth and other superficial deposits, separated by wide valleys and hollows. The terraces are highest and most fragmented by erosion in the north and west and most complete in the south.

The drainage pattern is determined largely by the three main drainage basins into which surface water flows. To the west, the broad valley of the Avon River is fed by six streams flowing westwards from the New Forest including Blackgutter/Ditchend Brook, Latchmore Brook, Dockens Water and Linford Brook. To the east, two further streams, Bartley Water and Cadnam River flow eastwards to the River Test and the upper reaches of the Southampton Water. To the south, a further three rivers flow into the Solent, The Lymington River, Beaulieu River and Avon Water.

The clay strata store relatively little water and lead to very rapid run off after rainfall and only small groundwater flows to the rivers in the summer months. Consequently, the New Forest streams are characterised by very high winter flood flows and very low summer flows. Monitoring information on groundwater flows is very limited; the Environment Agency have installed three boreholes into the unconfined Barton Sands, and more are planned.

The potential for geothermal energy, oil production, minerals and waste

Given that the New Forest is protected by the highest levels of protection afforded to nature conservation sites across Europe, it is highly unlikely that in the foreseeable future further attempts to exploit geothermal and oil reserves will become a reality. In the case of geothermal, the cost and technical issues with production currently make it an uneconomic proposition.

However, as described by West (2018), there is the potential for exploitation of both energy reserves which lay beneath the New Forest, especially given the availability of new technologies and mitigation techniques.

He gives details of the explorations conducted at Marchwood in 1979-1980 and oil borings in 1959 at Hazley Hill. Later attempts, in the 1970s to search for oil measures beneath Denny Wood Inclosure were refused at Public Inquiry.

The Hampshire, Portsmouth, Southampton, New Forest National Park and South Downs National Park Minerals and Waste Plan (usually referred to as the Hampshire Minerals and Waste Plan-October 2013 (Adopted)) sets out a vision, objectives, spatial strategy and policies to enable the delivery of sustainable minerals and waste development for Hampshire until 31 March 2030. Policy 3: Protection of habitats states that 'internationally protected sites will be given the statutory protection set out in the European Union Habitats Directive'. (Having left the European Union, UK legislation and regulation in this area may change.)

Geological Conservation Review (GCR) sites

The New Forest is of considerable importance in the national context for its seven GCR sites, which demonstrate aspects of the terrace gravels of the former Solent River and their associated Palaeolithic archaeology, as well as illustrating the evolution of more recent fluvial systems. The sites and their principal interest features are given in Table 5.

Table 5: Geological Conservation Review sites within the New Forest

GCR block	Site name and grid reference	Interest feature
Palaeogene	Studley Wood SU 227 158	A Tertiary locality exposing the only complete exposure of the silty Huntingbridge Formation of the Bracklesham Group, remarkable for its *Molluscan* fauna and the number of species limited to the formation. Numerous corals, scaphoda, bivalves and gastropods make it an outstanding Eocene locality of great interest in studies of Tertiary stratigraphy and palaeontology.
Palaeogene	Shepherd's Gutter SU 263 153	Renowned since the mid-19th century for its rich Tertiary marine faunas. It shows a section through the Selsey Formation of the Bracklesham Group, of mid Eocene age; and includes several mollusc-rich horizons and one kind of Nummulites correlatable with the Isle of Wight and Bracklesham sections. A key locality in correlations between the classic Eocene localities of the Hampshire Basin and for its prolific *Molluscan* fauna.
Palaeogene	Park Hill Inclosure SU 316 059	The only exposure in England outside the Isle of Wight to show upper middle Haedon Beds. The occurrence of fauna of *Cerithidea ventricosa* and

GCR block	Site name and grid reference	Interest feature
		other *Mollusca* in the Headon clays here allows correlation with the type sections of the Isle of Wight. The fauna of well-preserved shells and fish remains makes this one of the richest Tertiary faunal localities on the mainland. An important site for its palaeontology and for correlations within the Tertiary Hampshire Basin.
Pleistocene/ Quaternary	Mark Ash Wood (Church Moor) SU 247 069	A valley mire complex of considerable importance for palynological and palaeoecological studies. Peat growth at the site dates from the early part of the Devensian late glacial to the sub-Atlantic period. Church Moor contains the oldest post-glacial peats in the New Forest area and is exceptional for high accumulation rates during late-glacial times. Macrofossil and pollen analyses have yielded some of the earliest British post-glacial records of bryophytes. It is also important in tracing the early post-glacial immigration and expansion of plant species and has been used as a reference site for correlation in southern England.
Pleistocene/ Quaternary	Cranes Moor SU 194 028	A large mire complex, set in a shallow basin containing significant peat accumulations dating back to Devensian late-glacial times. It is a key reference site for palynological studies in southern England. It is also unusual for the apparently rapid accumulation of peat in the Boreal period and is therefore a particularly important in the study of the early immigration and expansion of flora in post-glacial times. Several studies of vegetational history have been carried out in the post-war period at a number of sub-sites within the basin including, most recently, an integrated investigation of macrofossils, pollen and other microfossils, together with radiocarbon correlation of cores.
Pleistocene/ Quaternary	Wood Green Gravel Pit SU 172 170	The pit exposes gravel, deposited by the River Avon, rich in palaeolithic artifacts. Palaeolithic assemblages provide major evidence for the subdivision of the terrace sequence in the Solent basin, where they are particularly important owing to a dearth of palaeontological sites.
Fluvial	Highland Water	This unique area demonstrates a combination of

GCR block	Site name and grid reference	Interest feature
geomorphology of England	SU 272 073 SU 239 123	low management and low human impact on fluvial processes. It is particularly important on two accounts. First, it provides a valuable opportunity to study the role and influence of vegetation in hydrological and fluvial processes. Second, it is of exceptional value for the study of debris dams which have a significant effect on channel processes, travel time of flood hydrographs channel roughness and channel processes. The hydrological and fluvial characteristics of the Highland water are typical of those that formerly occurred in much of southern England

Vegetation community descriptions and the use of the National Vegetation Classification (NVC)

As far as possible the New Forest vegetation communities are described in terms of the National Vegetation Classification (Rodwell, 1996). While this may appear to be a rather technical and somewhat daunting approach, it is necessary in order to classify the Forest plant communities to a recognised standard which can form the basis of evaluation at national and European level, enables ecologists and land managers to communicate, compare and contrast similar vegetation communities across the country and discern the impacts of different management operations upon them and to form a baseline for monitoring.

It should be recognised however that the 'fit' of some of the plant communities found in the New Forest (e.g. the pasture woodland communities) with the NVC is not always a close one. This is an issue related to initial limited sampling from the New Forest which has resulted in the NVC failing to pick up the full range of variation among UK vegetation communities. It is however more of a perceived problem than a real one if one considers the NVC as a continuum of vegetational variation with nodes (NVC classes) identified as discrete phytosociological associations. Considered in this dynamic fashion the NVC is immensely useful in enabling reliable predictions to be made about the direction in which plant communities are moving or will move if subject to different treatments. For example, decreased grazing pressure of the mire community M29 will change it over time to a *Molinia* dominated M25 community. The lack of a comfortable 'fit' of certain New Forest plant communities is simply a consequence of a lack of identified nodes (or NVC communities or more correctly subcommunities) which can be added under later revisions to the NVC following more systematic sampling of the Forest vegetation.

In compiling the NVC descriptions the expertise and quadrat data collected by Neil Sanderson has been extensively called upon. Most of what follows is based upon his work, compiled under contract to English Nature (now Natural England).

New Forest pasture woodland: description

Pasture woodland includes all of those woodland stands which depend upon grazing by livestock to maintain the special interest features. (While this definition embraces Open Forest stands of riverine and bog woodland these are dealt with separately under their respective headings.) The special interest features may be summarised as:

Great structural diversity with a complete range of tree age classes from saplings to mature, senile and dead standing and fallen trees. A wide range of density of trees from closed high canopy forest to open stands with heathy or grassy lawns and glades to a more parkland-like structure.

- an exceptionally rich lichen flora
- an exceptionally rich invertebrate fauna
- an exceptionally rich breeding bird fauna
- an exceptionally rich bryophyte flora
- an exceptionally rich fungal flora

Sanderson (1998) recognises four distinctive vegetation communities (based on ground flora) comprising the New Forest pasture woodlands. This classification was validated by Sanderson in 1999 in a 50-quadrat sample across the Forest commissioned by English Nature (Sanderson, 1999). The four community types are:

Type A: (*Vaccinium myrtillus-Dicranum majus* type) pasture woodland with ground flora (vascular plants and mosses) characteristic of very acid soils.

Type B: (*Agrostis capillaris-Thuidium* type, typical variant) pasture woodland with ground flora (vascular plants and mosses) characteristic of less acid soils but spring vernal species absent.

Type C: (*Agrostis capillaris-Thuidium* type, *Oxalis-Anemone-Hyacinthoides* variant) pasture woodland with ground flora (vascular plants and mosses) characteristic of less acid soils but spring vernal species present. Moss mats are well developed but lack species typical of very acid soils.

Type D: (*Agrostis stolonifera-Viola-Ranunculus ficaria* type) pasture woodland with herbs typical of base-rich soils present with poorer moss mats. Divided into *1.1: Riparian Woodland* and *1.2 Woodland above the floodplain.*

These are referable to the NVC and for the purposes of comparative evaluation are described in NVC terms below. However, there are recognised difficulties in comfortably accommodating the various New Forest pasture woodland stands within the NVC, particularly the beech stands, largely as a result of the relative paucity of quadrat sampling taken from the Forest in the original compilation of the NVC and the impact of centuries of grazing management (or rather the collapse of grazing management in most other pasture woodland beech stands elsewhere). The grazing has resulted in a greater cover and diversity of bryophytes and a reduction in the prominence of ground flora sensitive to high grazing pressure, which gives the beech communities W15 (Type A) and W14 (Type B and C) an affinity to the western oakwood stands of W17 and W11. This is less problematic for the oak dominated stands.

Other terms used to describe the Crown Lands pasture woodlands are in common use today are:

Ancient and Ornamental Woodland
A term uniquely applied to pasture woodland communities within the Crown Lands of the New Forest. It embraces both ancient woodland that has remained under woodland cover for at least the last 400 years and the non-ancient secondary woodland that has developed in more recent times. The latter category includes the birch woods, holly groves and mixed emergent woodland mainly of oak and beech which have expanded onto open heathland communities in response to reduced deer-browsing impact as a result of the introduction of the Deer Removal Act of 1851. The term also applies to the riparian woodlands of the Open Forest.

Pre-Inclosure Woodland
A term applied to those surviving elements of former pasture woodland which now lie within Statutory Inclosures on the Crown Lands and as such are no longer subject to Open Forest grazing management.

Qualifying Feature equivalents

The following Annex I habitats are present in the New Forest pasture woodlands:

- *Asperulo-Fagetum* beech forests.

- Atlantic acidophilous beech forests with *Ilex* and sometimes *Taxus* in the shrub layer.

- Old acidophilous oak woods with *Quercus robur* on sandy plains.

NB: In comparing New Forest pasture woodland stands to Annex I habitat types the definition of beech woodland as opposed to oak woodland is critical. Sanderson (2000; personal communication) has suggested using an ecological definition rather than simple beech or oak dominance. The beech wood ecosystem is a dynamic one in which dominance can oscillate between different species. Beech is an efficient coloniser and has occupied virtually all the very acid soil within the old growth woodlands. Total beech dominance is more likely to be the result of planting, since more natural beech dominated stands tend to be mixed to at least some degree. In the New Forest beech woods are best defined as those woods with beech in them as a long-term component in the canopy. Given the data set available in Flower and Tubbs (1982) it is reasonable to include all stands with canopy beech at more than 10% mapped by Flower and Tubbs (1982) as ecologically a beech wood. Mapped canopy classes of beech in Flower and Tubbs (1982) are 0-10%, 10-50 %, 50-90% and 90-100%. Describing woods of 30-40% beech as oak woods is not practical. In the New Forest pure beech or pure oak stands are rare; most exist as a mixture. Only old growth pasture woodland is strictly referable to Annex I habitats.

The pasture woodland stand types and their relationship with the Qualifying Feature Annex I habitats is presented on Tables 6 and 7.

Pasture woodland community descriptions

Type A (*Vaccinium-Dicranum majus* type):

Pasture woodland with ground flora (vascular plants and mosses) characteristic of very acid soils, usually with *Vaccinium myrtillus* and mixed bryophyte mats, typically with the moss *Dicranum majus*. Grasses are absent or restricted largely to *Deschampsia flexuosa*. While tightly grazed communities have affinities with NVC community W17 (*Quercus petraea-Betula pubescens-Dicranum majus* woodland), they are, along with less tightly grazed stands, referable to W15 and W16. In practice in the New Forest these latter two communities often exist in a complex and indefinable mosaic. An average of 19 species were recorded per quadrat, the same as the closest NVC beech stand W15c, the *Vaccinium myrtillus* subcommunity.

W15: Beech-Wavy hair-grass woodland (*Fagus sylvatica-Deschampsia flexuosa* woodland). Further definition to subcommunity level is not possible.

The New Forest communities are characterised by a mosaic of *Fagus sylvatica* and *Quercus* spp. (featuring many old pollards) with occasional *Betula pubescens* over a shrub layer often dominated by *Ilex aquifolium* with occasional *Ruscus aculeatus* and *Lonicera periclymenum*. Soils are mostly strongly acid stagnogleys and stagnogleyic argillic brown earths whose extreme edaphic conditions excludes *Corylus avellana* and *Crataegus monogyna*. Large areas of ground flora are composed of moss mats featuring *Dicranum scoparium, Leucobryum glaucum agg, Dicranella heteromalla, Mnium hornum*, with *Polytrichum formosum, Plagiothecium undulatum, Hypnum jutlandicum, Isothecium myosuroides* and others. Grasses are restricted to *Deschampsia flexuosa* with occasional *Holcus mollis* and *Molinia caerulea* all heavily influenced by grazing. Associated herbs are sparse but include *Melampyrum pratense, Oxalis acetosella* and depending upon grazing pressure, *Vaccinium myrtillus*.

Qualifying Feature equivalent

Old growth woodland accommodated within the Annex I habitat *Atlantic acidophilous beech forests* with *Ilex* and sometimes *Taxus* in the shrub layer.

Distribution and extent of W15

The Atlantic acidophilous beech is taken as including both the strongly acid W15 stands which form the bulk of the community, but also the less acidic but herb-poor W14 beech stands. No individual NVC areas are available but there is approximately 2,580ha of W15/W14 of which some 2,000ha is old growth attributable to the Annex I habitat.

W16: Oak species-Birch species-Wavy Hair-grass woodland (*Quercus* spp.-*Betula spp.-Deschampsia flexuosa* woodland)

This exists mainly as recent stands (19th century) of oak, birch and pine, on former heathland often with young beech present indicating a long-term succession to beech woods. The flora is very poor, usually bracken dominated and lacking the distinctive moss mats of the beech-oak stands. The latter appear to be a feature of ancient woodland, which on strongly acid soils is invariably beech wood. However, it is also found within the mainly beech dominated W15 stands as patches of oak dominance supporting a ground flora with a richer moss flora as described under W15.

Both W15 and W16 communities may be invaded by *Rhododendron ponticum* or support stands of planted or naturally regenerated *Pinus sylvestris*. For both of these species cover above 1% would require management intervention to restore favourable condition.

Qualifying Feature equivalent

Old growth woodland is accommodated within the Annex I habitat *Old acidophilous oak woods* with *Quercus robur* on sandy plains.

Distribution and extent of W16:

The acid/mesotrophic herb-poor oak woodland is a combination of W16 and W10a/W11. Of approximately 4,430ha of pasture woodland a maximum of 120ha is old growth referable to the Annex I habitat, existing largely in an intimate mosaic with W15. A further 750ha is largely secondary emergent blocks on former heathland. No individual NVC areas are available.

Table 6: Pasture woodland stand types and their relationship with the Qualifying Feature Annex I habitat

NVC	Oak/beech	Sanderson type	Close affinity with	Habitats Directive
W15	Acid lowland beech	A	W17 northwest oak	Atlantic acidophilous beech
W16	Acid lowland oak	A	W17 northwest oak	Old acidophilous oak
W14	Acid-mesotrophic lowland beech herb-poor	B	W11 northwest oak	Atlantic acidophilous beech
W10a/11	Mesotrophic lowland oak herb-poor	B	W11 northwest oak	Old acidophilous oak
W10b/11	Mesotrophic lowland oak herb-rich	C	W11 northwest oak	No equivalent
W14	Mesotrophic lowland beech herb-rich	C	W11 northwest oak	*Asperulo-Fagetum* beech woods
W8b	Base-rich ash (but may be beech dominated)	D1.2	W14 mesotrophic lowland beech herb-rich	*Asperulo-Fagetum* beech woods

Table 7: Estimated areas of NVC communities, old growth pasture woodland and Qualifying Feature types

NVC	Area (ha)	Old growth woodland (ha)	Qualifying Feature
W15/W14	2,580	2,000	Atlantic acidophilous beech (2,000ha)
W16 W10a/11	870	120	Old acidophilous oak (120ha)
W10b/11	580	580	No equivalent
W14/W8b	400	400	*Asperulo-Fagetum* beech woods (400ha)
	Total: 4,430	Total: 3,100	Total: 2,520

Of a total of approximately 4,430ha of pasture woodland, 2,520ha is old growth conforming to the Qualifying Feature categories. The remainder is either recent secondary on heathland or mesotrophic lowland herb-rich oak woodland (580ha) which has no Qualifying Feature equivalent. There is approximately 3,100ha of old growth pasture woodland, excluding riverine and bog woodland.

Type B (*Agrostis capillaris-Thuidium* type, typical variant):

Pasture woodland with ground flora (vascular plants and mosses) characteristic of less acid soils but spring vernal species absent. Still supporting mixed moss mats but *Dicranum majus* is absent or rare, while *Thuidium tamariscinum* becomes prominent. *Vaccinium myrtillus* is absent and *Deschampsia flexuosa* is replaced by *Agrostis capillaris*. Tightly grazed communities are indistinguishable from the NVC community W11 (*Quercus petraea-Betula pubescens-Oxalis acetosella* woodland), but those with beech in the canopy are referred to W14. As for the W15 and W16 communities described above, in practice in the New Forest W11 and W14 communities often exist in a complex and indefinable mosaic. In ungrazed oak dominated stands the W11 communities rapidly convert to W10a. An average of 22 species per quadrat was recorded from the Type B community. This is far more than W14, which has 12 species per quadrat but closer to W10a which has 18. The closest W11 subcommunity, W11a has more at 27 per quadrat. Similar but now ungrazed ex-pasture woodland in The Mens, Sussex averaged 14 species (Sanderson, 1997), much closer to W14 indicating that the cessation of grazing results in considerable species impoverishment at a quadrat level.

W14: Beech-Bramble Woodland (*Fagus sylvatica-Rubus fruticosus* woodland)

Typically, *Fagus sylvatica* is prominent with older stands containing magnificent old pollards, *Quercus* spp. are frequent and may gain equal dominance depending upon past management, regeneration events and local edaphic variations in soil moisture. Occasional *Taxus* and *Sorbus aucuparia* are present. Gaps in the canopy are colonised initially by *Betula pubescens,* with saplings of *Quercus* and *Fagus* protected from grazing by *Ilex* scrub, bracken and/or fallen wood. *Ilex aquifolium* is dominant in the shrub layer often casting dense shade where periods of dense regeneration and growth occurred during periods of relaxed grazing particularly after the practice of holly pollarding ceased following the Deer Removal Act 1851. Indeed, emergent stands of 'holly hats' with or without associated trees are a feature of the Forest landscape.

Soils are base-poor brown earths with some impeded drainage and typical stagnogleys and are able to support a scatter of *Crataegus monogyna*, while *Pteridium aquilinum* is not as abundant as in W15 stands. The field layer characteristically supports a fairly impoverished flora (due to poor soils and variable light conditions), with *Potentilla erecta, Agrostis capillaris* being prominent with occasional *Galium saxatile, Viola riviniana, Oxalis acetosella* and *Melampyrum arvense*. Spring vernals such as *Hyacinthoides non-scripta* and *Anemone nemorosa* are absent. Moss mats are still prevalent with *Thuidium tamariscinum, Polytrichum formosum, Dicranella heteromalla* and *Mnium hornum* all frequent, but *Dicranum majus* rare or absent.

Qualifying Feature equivalent

Accommodated within the Annex I habitat *Atlantic acidophilous beech forests* with *Ilex* and sometimes *Taxus* in the shrub layer.

Distribution and extent of W14 (acid, species-poor)

See W15 above.

W11 Oak-Birch-Oxalis woodland (*Quercus petraea-Betula pubescens-Oxalis* woodland) and/or W10a Pedunculate Oak-Bracken-Bramble woodland (*Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland-Typical subcommunity)

In the Forest this community type is species-poor and rather similar to that described above, but characterised by *Quercus* spp. dominance over *Fagus sylvatica*, though local tree cover dominance is dependent upon previous management and regeneration events. *Betula pendula* occurs frequently in canopy gaps and *Ilex aquifolium* may be dominant in the understory with *Crataegus* and *Corylus* present but the latter is much reduced by past coppicing in the presence of grazing. The ground layer is largely indistinguishable from that

described above for W14 although bracken can be more abundant.

Qualifying Feature equivalent

Accommodated within the Annex I habitat *Old acidophilous oak woods with Quercus robur on sandy plains.*

Distribution and extent of W11/W10a

See W16 above.

Type C (*Agrostis capillaris-Thuidium* type, *Oxalis-Anemone-Hyacinthoides* variant):

Pasture woodland with ground flora (vascular plants and mosses) characteristic of less acid soils but spring vernal species present. Moss mats are well developed but lack species typical of very acid soils. The beech stands are referred to W14 but are not typical as they are still grazed. Where the oak dominated stands are tightly grazed, they are identical with NVC community W11 (*Quercus petraea-Betula pubescens-Oxalis acetosella* woodland) but reduced grazing results in stands referable to W10b. Once again, in practice in the New Forest W11 and W14 communities often exist in a complex and indefinable mosaic. An average of 25 species per quadrat was recorded from the Type C samples. This is far more than the nearest lowland NVC communities; W10b that has an average of only 13 species per quadrat and W14 with 12 per quadrat. The nearest upland community, W11a has an average of 27 species per quadrat.

W14: Beech-Bramble Woodland (*Fagus sylvatica-Rubus fruticosus* Woodland), W11 Oak-Birch-Oxalis woodland (*Quercus petraea-Betula pubescens-Oxalis* woodland) W10b and Pedunculate Oak-Bracken-Bramble woodland-Wood Anemone subcommunity (*Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland-*Anemone nemorosa* subcommunity)

These communities are very similar to those described above but distinguished by the presence of *Hyacinthoides non-scripta* and *Anemone nemorosa* and *Crataegus monogyna* being much more frequent.

Qualifying Feature equivalent

W14 (mesotrophic herb-rich): Accommodated within the Annex I habitat *Asperulo-Fagetum beech woods.*

W11/10b: No Qualifying Feature equivalent.

Distribution and extent of W14/W10b:

W14 (mesotrophic herb-rich)/W8b: around 400ha in total.

W11/10b: Around 580ha in total.

Type D (*Agrostis stolonifera-Viola-Ranunculus ficaria* type):

Pasture woodland with herbs typical of base-rich soils present with poorer moss mats. Divided into *1.1: Riparian Woodland* (described below) and *1.2 Woodland above the floodplain.* Characterised by the presence of herbs such as *Ranunculus ficaria, Sanicula europaea. Primula vulgaris, Circaea lutetiana* and *Arum maculatum* on base-rich flushed soils. Attributable to NVC community W8b or herb-rich forms of W14 where *Fagus sylvatica* is the dominant canopy species but modified by grazing. These herb-rich forms of W14 can also be found on former pasture woodlands in The Weald at Ebernoe Common and The Mens (Sanderson, 1997) and appear characteristic of pasture woodlands on base-rich clay soils. Off pasture woodland, beech was excluded from coppices on similar soils. Type D had an average of 30 species per quadrat on stands off the floodplains somewhat higher than the average for NVC community W8b that had 26 species per quadrat recorded. The ungrazed former pasture woodland stands in The Mens, Sussex had an average of 21 species per quadrat (Sanderson, 1997), indicating that the cessation of grazing results in considerable species impoverishment at a quadrat level.

W8b: Ash-Field Maple-Dogs Mercury Woodland-Wood Anemone subcommunity (*Fraxinus excelsior-Acer campestre-Mercurialis perennis* woodland-*Anemone nemorosa* subcommunity)

In the New Forest this community lies on damp stagnogleyic, base-rich soils above the floodplain; it is strikingly rich in vascular plants in comparison with its more acid counterparts described above. Canopy composition is varied and may be locally dominated by *Fraxinus excelsior, Quercus robur, Quercus petraea* or *Fagus sylvatica*, over a shrub layer in which *Corylus avellana* features more strongly with common associates including *Crataegus monogyna, Prunus spinosa* and even *Sorbus torminalis* on occasions. *Ilex aquifolium*, characteristic of less base-rich areas may also be present in Forest stands.

The ground flora is dominated seasonally by spring vernals *Hyacinthoides non-scripta* and *Anemone nemorosa*, among a rich flora the structure and composition of which is strongly influenced by grazing pressure and canopy density. Typical associates include *Primula vulgaris, Oxalis acetosella, Viola riviniana, Agrostis capillaris, A. stolonifera, Melica uniflora, Conopodium majus, Ranunculus ficaria, Euphorbia amygdaloides, Deschampsia cespitosa* and *Lysimachia nummularia.* Bryophytes are few in species compared to the more acidic communities, represented largely by *Polytrichum formosum, Eurhyncium strialatum,*

Thuidium tamariscinum and *Isothecium myosuroides*.

Qualifying Feature equivalent

Stands with beech can be accommodated within the Annex I habitat *Asperulo-Fagetum beech Woods*. Oak stands have no equivalent.

Distribution and extent of W8b

Of approximately 4,430ha of pasture woodland around 400ha is herb-rich W14/W8b beech wood.

New Forest riverine woodland: description

New Forest riverine woodland comprises those woodland stands with occasional to abundant *Alnus glutinosa* and frequent *Fraxinus excelsior* on wet mineral or peaty soils along water courses. It incorporates the Qualifying Feature Annex I habitat *Alluvial forests with Alnus glutinosa and Fraxinus excelsior.*

In terms of the NVC, riverine woodland is referable to either W8 or W7 and grades gradually between the two communities.

Riverine woodland community description

Woodland stands on floodplains which, where not damaged by over deepening of drainage channels, flood seasonally as water levels rise along meandering natural flood channels containing debris dams. Species intolerant of such conditions are rare (e.g. beech) or confined to slightly raised areas and rich alluvial soils with higher base status produce a very rich woodland flora, though modified by grazing animals. *Carex paniculata* is absent (characteristic of alder carr on peat W5b) and *Molinia caerulea* is very uncommon (characteristic of *Salix* carr W4b). Riverine woodland communities are referable to NVC communities W8, of which two subcommunities W8b or W8f are present; and W7, of which two subcommunities W7a and W7b, are present. The Sanderson Type D stands from floodplains represent the stands closest to W8b, these have some W7 ground flora species but low alder cover. The true W7 stands, with a high alder cover were not sampled, as these do not differ much from those described in the NVC.

W8: Ash-Maple-Dogs Mercury Woodland (*Fraxinus excelsior-Acer campestre-Mercurialis* Woodland)

On mineral soils *Alnus glutinosa* is absent to occasional and is confined to channel banks. Dominant species are usually *Quercus robur* and *Fraxinus excelsior* with occasional *Acer campestre*. The tree canopy can include ancient trees and most stands are old growth, except those by the Avon Water. There is also a very rich shrub layer including *Corylus avellana, Crataegus monogyna, Cornus sanguinea*, *Euonymus europaeus*, *Ligustrum vulgare* and *Prunus spinosa*, with frequent *Ilex aquifolium, Rubus fruticosus* and *Rosa* spp. The ground flora is generally very rich. Typical species include *Viola riviniana, Veronica montana*, *Lysimachia vulgaris, Ranunculus ficaria, Euphorbia amygdaloides, Cardamine pratensis* and the fern *Athyrium filix-femina*. In the Avon Water *Allium ursinum* is dominant. The woodland on drier soil is closest to W8 with the *Allium ursinum* subcommunity in the Avon Water and the *Anemone nemorosa* subcommunity in other areas. The latter was sampled as Sanderson Type D (*Agrostis stolonifera-Viola-Ranunculus ficaria* type) woodland. This was found to have an average of 40 species per quadrat and ranged from 32 to 48. This is far richer than W8b which had an average of 26 and ranged from 12 to 35. In fact no subcommunity of W8 averages above 29 species per quadrat. Only the upland (and very different) W9 is as rich and, at a quadrat level, the floodplain W8 stands of the New Forest appear to be among the richest lowland woods in Britain.

Most stands are flooded, to as much as 1m deep, for up to two weeks a year in winter or spring.

The community is prone to invasion by *Acer pseudoplatanus* which should be controlled to cover values of below 1% or eradicated.

W7: Alder-Ash-Yellow Pimpernel woodland (*Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum* woodland)

Alnus glutinosa abruptly increases its cover in areas wherever there is some peat accumulation as in old channels and where springs arise in the floodplain. Characterised by stands of *Alnus glutinosa*, often multi-stemmed from previous coppice management, with frequent *Fraxinus excelsior* and occasional *Quercus robur.* The shrub layer is much poorer than in the drier floodplain woodland but *Ilex aquifolium* can be frequent around the *Alnus* stools and *Salix* is usually present.

The ground flora is characterised by a prominence of wetland species such as *Carex remota*, *Lysimachia nemorum*, *Ajuga reptans*, *Valeriana dioica*, *Mentha aquatica*, *Athyrium filix-femina*, *Galium palustre* and *Caltha palustris*. Most stands in the floodplains have *Chrysosplenium oppositifolium*, which is absent from the W7 stands in hillside flushes reflecting increased nutrient input from flooding making the former referable to W7a: Alder-

Ash-Yellow Pimpernel woodland-Common Nettle subcommunity (*Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum* woodland-*Urtica dioica* subcommunity). Species characteristic of W7b: Alder-Ash-Yellow Pimpernel woodland-Remote Sedge-Marsh Thistle subcommunity (*Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum* woodland-*Carex remota-Cirsium palustre* subcommunity) are, however, invariably present within the same stands and most are transitional or mosaics of W7a and W7b.

Qualifying Feature equivalent

Accommodated within the Annex I habitat *Alluvial forests with Alnus glutinosa and Fraxinus excelsior.*

Distribution and extent of riverine woodland

There are around 212ha of old growth riverine woodland in the New Forest distributed on alluvial mineral soils along the various watercourses. The distribution of riverine woodland in the New Forest is shown on Map 1 at the end of this Part 1 document.

New Forest bog woodland: description

The term bog woodland is used here to define woodland communities on peat in which there is a significant component of bog species in the ground flora as opposed to riverine woodland on mineral (alluvial) soils which lack bog species. This definition incorporates the Qualifying Feature Annex I habitat *Bog woodland*, but also includes alder and willow carr associated with mires and wet heath.

In terms of the National Vegetation Classification, New Forest bog woodland communities are referable to W4b and W5b. The Qualifying Feature Annex I habitat *Bog woodland* is referable to W4. The distribution of bog woodland in the New Forest is shown on Map 2 at the end of this document.

Bog woodland community descriptions

The bog woodland communities in the New Forest are of two main types: the sallow carrs, a feature of the acid headwaters and mires characterised by a significant sphagna component in the ground flora, giving way to alder carr on richer soils in valleys on swampy ground, where sphagna are replaced by *Carex paniculata*. The sallow cars are referable to NVC W4b while the alder carrs are referable to W5b. However, in the New Forest transitions with both *Sphagnum* spp. and *Carex paniculata* occur.

W4b: Downy Birch-Purple Moor-grass woodland-Soft-rush subcommunity (*Betula pubescens-Molinia caerulea* woodland-*Juncus effusus* subcommunity)

Canopy dominated by *Betula pubescens* with varying amounts of *Salix cinerea* and occasional *Alnus glutinosa* over an open bog habitat. While some is of very ancient origin and stable (e.g. Church Moor contains the oldest post-glacial peats in the New Forest, dating back from the early part of the Devensian late glacial), all is young growth, while some is recent woodland expansion onto valley mire. *(Note that the 'Poor Fen' community M6di changes to W4b as a result of birch and willow invasion.)* Alder in W4b appears to be confined to ancient stands and is totally absent from stands that have colonised open mire in the last 130 years.

Molinia caerulea is constant though controlled by grazing and *Juncus acutiflorus* replaces *J. effusus* of the NVC community title in the New Forest communities. Where the ground layer has *Sphagnum* carpets these are dominated by *Sphagnum recurvum* with *S. palustre* with typical poor fen (M6di) associates including *Hydrocotyle vulgaris*, *Lotus pedunculatus*, *Viola palustre* and *Carex curta.*

The community occurs on peat typically along the central zone of the larger valley mires where it may be seen as the base-poor equivalent of W7. It is strongly influenced by Open Forest management regimes and Scots pine invasion, birch, willow and *Molinia caerulea* dominance are controlled by prescribed burning and grazing by deer and commoners' animals.

Qualifying Feature equivalent

The ancient bog woodland stands (e.g. at Church Moor) are referable to Qualifying Feature Annex I habitat *Bog woodland.*

Distribution and extent of W4b

Bog woodland is quite a widespread habitat within the valley mires. At least a third (about 66ha) of the total carr area of some 200-250ha is referable to W4b of which half (33ha) is likely to be ancient in the Annex I Qualifying Feature sense.

W5b: Alder-Tussock-sedge Woodland-Yellow Loosestrife subcommunity (*Alnus glutinosa-Carex paniculata woodland-Lysimachia vulgaris* subcommunity)

Characterised by an abundance and ultimate dominance of *Alnus glutinosa*, often multi-stemmed from previous (though now abandoned) Forest coppice rotations, with occasional *Salix cinerea* and *Betula pubescens* with *Frangula alnus* in the shrub layer over shade-tolerant *Carex paniculata* tussocks.

The species complement in the ground layer is dependent upon the amount of light which can get through the canopy, but the base-rich soils are capable of supporting a rich fen woodland flora. This includes species such as *Lysimachia vulgaris, Mentha aquatica, Lythrum salicaria, Lycopus europaeus, Ranunculus flammula* and *Carex remota*. Notable among an often-rich fern component is the presence of *Osmunda regalis*.

Soils are waterlogged, relatively base-rich and moderately eutrophic over peats along the central strips of floodplain valley mires.

Qualifying Feature equivalent

None.

Distribution and extent of W5b

About two thirds (180ha) of the total bog woodland on peat (200-250ha) is referable to W5b.

New Forest Inclosure woodland: description

A detailed history of the enclosing of Forest land to create managed woodland is given in Annex A of Part 1, under ‘Land use history’.

These woodlands were originally fenced from Open Forest livestock grazing for the purpose of growing trees for timber production (silviculture). On the Crown Lands many of these Inclosures remain fenced off from free ranging animals although frequent incursions occur. Off the Crown Lands they are remote from commoners’ animals and may not have been grazed by livestock for a considerable period if at all.

Crown Land Inclosures

The Inclosures on the Crown Lands date from the 18th and 19th century (Statutory Inclosures) and also from the mid-20th century (Verderers’ Inclosures) and were enclosed for the purpose of silviculture. All are planted on areas of former heathland and woodland. In some instances within the Statutory Inclosures small pockets of ‘pre-Inclosure woodland’ were not felled and remain today as part of the varied structure of these woodlands.

Up until the mid-19th century the tree species planted were native, predominately oak and beech. From the 1850s onwards a number of conifer species were also planted in addition to native broadleaves. Tree species composition varies enormously, with predominately

oak, beech and Douglas fir often favoured for planting on richer soils and a greater proportion of conifers (predominately species of pine) planted on poorer soils.

Within these Inclosures the age of plantations ranges from around 250 years old through to stands of young trees that are one to two years old. In the Statutory Inclosures some of the oldest broadleaved stands are beginning to develop a significant nature conservation interest particularly where they were planted on former woodland sites (probably ancient). In the Verderers' Inclosures the nature conservation value is restricted to surviving remnant heath and mire communities and the very high potential for heathland restoration following conifer removal.

Extensive manipulation of the underlying soils, drainage and vegetation has occurred in most Inclosures. Remnants of semi-natural vegetation may or may not be discernible, depending upon the density of planting and other interventions.

Where recognisable remnant plant communities can be referred to those heathlands and woodland NVC types and Qualifying Feature Annex I habitats described elsewhere. Particularly significant in this regard are the 400ha of pasture, riverine and bog woodland communities which were incorporated within 18th and 19th century Statutory Inclosures.

Today the Inclosure woodlands support great silvicultural diversity, with a range of tree species (both native and non-native) and a variety of ages, structures and species compositions within stands. Some of the fenced Statutory Inclosures also support conservation interests not found on the hard-grazed Open Forest—most notably some invertebrate species (refer to New Forest invertebrates section in this document).

Within the Crown Lands, Forestry England has recently undertaken a full review of Inclosure management, with a new plan to guide future strategic direction. This plan has been through various consultations and is now the approved New Forest Inclosures Forest Plan 2019-2029.

The direction of the Plan builds on the momentum of the previous 20 years, moving the management of the Inclosures towards favouring native broadleaf over conifer in the light of the outstanding nature conservation value of the New Forest SAC. All plantations were either planted on ancient forest or heathland and the recovery of these SAC habitats is now a priority for Forestry England, as reflected in the Plan.

The principal objective is to maintain or restore SAC habitats under plantations to either broadleaf woodland or heathland. Over the next 30-50 years and as the current crop of conifer matures and is harvested, there will be no further planting of conifer and its regeneration will be actively controlled to favour broadleaf on sites which were formerly broadleaf and/or pasture woodland.

On sites which were formerly heathland it will be very important to keep the conifer plantations clear of any broadleaf regeneration so that on maturity and clear-fell of the conifer plantation, the recovery of heathland is not compromised by the presence of broadleaf regeneration and the nutrient issues which it inevitably presents.

In addition, a long-term aim is to manage existing broadleaf plantations for timber production and these areas will remain enclosed.

Extent and distribution of Crown Land Inclosures

There is a total of 8,410ha of enclosed plantation woodland within the Crown Lands. Its distribution is shown on Map 3 at the end of this document.

The Statutory Inclosures (7,104ha) were enclosed under specific Acts of Parliament. They are free of Rights of Common only so long as they remain fenced, while at least 12% has to remain unenclosed at any one time.

The Verderers' Inclosures (814ha) were enclosed by agreement with the Verderers in the late 1950s on the understanding that they would be returned to the Open Forest after a limited time span.

In addition to the Statutory and Verderers' Inclosures there are 494ha of Crown freehold woodland, most of which derive from the old Crown manor of Lyndhurst, as well as a further 198ha leased from adjoining estates.

Enclosed woodland outside the Crown Lands (outside the perambulation)

Off the Crown Lands, semi-natural woodland stands are referable to those communities previously described under pasture woodland, bog woodland and riverine woodland though they may vary considerably in gross appearance and detailed species composition as a result of differing woodland management systems (coppice or high forest) in the absence of livestock grazing.

Distribution of enclosed woodland outside the perambulation

Principal localities are at Whiteparish Common, Loosehanger Wood, Langley Wood and Franchises Wood in the north of the SAC in Wiltshire, as well as Roydon Wood in the south of the Forest in Hampshire.

Table 8: Woodland areas and principal NVC/Habitats Directive Community types

Site name	NVC community	Qualifying Feature Annex I habitat
Franchises Wood	W14, W10	*Asperulo-Fagetum* beech forests Atlantic acidophilous beech forests
Langley Wood	W10, W8, W7b	Old acidophilous oak woods
Loosehanger Copse	W10, W16	Old acidophilous oak woods
Roydon Wood	W10a, W10b, W8a, W8b, W7b, W14, W15	Alluvial forests with *Alnus glutinosa* and *Fraxinus* *Asperulo-Fagetum* beech forests Old acidophilous oak woods Atlantic acidophilous beech forests
Whiteparish Common	W14	*Asperulo-Fagetum* beech forests

New Forest dry heath: description

The New Forest dry heaths comprise a suite of vegetation communities defined largely along a soil moisture gradient. The various communities are identifiable as nodes along a continuum from the driest, poorest soils through those of intermediate moisture and slightly higher nutrient status to those too wet to support *Erica cinerea* but not wet enough to support sphagna and wet heath communities. This classification embraces the traditional classification of Forest dry and humid heath e.g. Tubbs (1986) and Westerhoff and Clarke (1988) but provides greater definition and enables comparative evaluation against other heathland communities at the national and European level to be made. (In particular, it avoids the difficulties and potential confusion of the inclusion of *E. cinerea* in the definition of humid heath in the Westerhoff and Clarke classification.)

In terms of the NVC the driest heaths are referable to H2a and H3c, while increasing soil moisture brings in H2c, H3a and H3b and an additional community not described in the NVC. The latter, an extreme form of H2c, occurs on soils too wet for *Erica cinerea* but not wet enough for sphagna and which Sanderson (1992) has provisionally named *Calluna-Molinia-Erica tetralix-Leucobryum glaucum* heath. This community is the true ‘humid heath’ in the more widely accepted sense of the term, which in the New Forest is an extensive band between the drier communities and wet heath.

All are included within the Qualifying Feature Annex I habitat *European dry heaths.*

Table 9: The relationship between earlier classification, the NVC and the Qualifying Feature

Westerhoff and Clarke (1988)	Tubbs (1986)	NVC (dry heath communities)	Qualifying Feature
Dry Heath Humid Heath	Dry Heath Dry Heath Humid Heath	H2a, H3c H2c, H3a, H3b and unclassified *Calluna-Molinia-Erica tetralix-Leucobryum glaucum* heath	European dry heaths

While soil moisture and probably soil nutrient status are the principal community determinants, the physical structure/appearance of the dwarf-shrubs and presence and abundance of associated species are heavily influenced by prescribed burning and grazing. There are around 7,600ha of dry heath in the New Forest. Its distribution is shown in Map 4 at the end of this document.

Dry heath community descriptions

New Forest dry heath comprises two main NVC communities (and six subcommunities), H2: Heather-Dwarf Gorse Heath (*Calluna vulgaris-Ulex minor*) heath and H3: Dwarf Gorse-Bristle Bent heath-(*Ulex minor-Agrostis curtisii*) heath. H3 is differentiated from H2 by the presence of *Agrostis curtisii* which is likely to be due to a slight elevation in available plant nutrients in soils supporting H3 communities.

When in favourable condition dry heath exhibits a structural mosaic of *Erica*ceous vegetation with at least 10% young (pioneer phase for *Calluna vulgaris*) and between 20% and 50% old (mature or degenerate phase for *Calluna vulgaris*). Cover of *Calluna vulgaris* lies between 25% and 90%. There is between 1% and 10% bare ground forming an intimate mosaic with the vegetation, but not in an extensive form as a result of intensive stock feeding or human disturbance. Cover of invasive species such as *Rhododendron ponticum* above 1%, or pine trees or seedlings above 5% would require management intervention. *Pteridium aquilinum* cover should not normally exceed 25% cover in any unit, while not more than 10% of *Ulex europaeus* should be in a degenerate condition.

H2a: Heather-Dwarf Gorse Heath-Typical subcommunity (*Calluna vulgaris-Ulex minor* heath-typical subcommunity)

Characterised by the dominance of *Calluna vulgaris*, with varying amounts of *Erica cinerea* and *Ulex minor*, as well as the absence of *Agrostis curtisii*, *Erica tetralix* and *Molinia caerulea*. This is the driest of the dry heaths occurring on highly impoverished, freely draining acid podzols. Typical associates include *Pteridium aquilinum* and occasionally, but not always, *Deschampsia flexuosa*. The relative scarcity of the palatable *Ulex minor* in some stands is probably a result of preferential grazing (Tubbs, 1986).

The physical structure of the dry heath and relative abundance of *Calluna vulgaris* and *Erica cinerea* are dependent upon the time elapsed since the community was last burnt. It is notable that prescribed burning of this community does not produce a flush of palatable grasses but stands remain substantially bare while first *E. cinerea* with its prolific seeding ability dominates initially, then *Calluna* gradually re-establishes over 2-4 years. Rich lichen communities are a late successional feature of canopy gaps in heaths recovering from burning. Greatest biodiversity will be found where a structural mosaic of heather is present over the community as a whole with at least 10% in the pioneer phase and between 20% and 50% in the mature or degenerate phase and between 1% and 10% bare ground forming an intimate mosaic with the vegetation. Stands on south-facing sandy slopes may be particularly important for certain invertebrate species and reptiles.

The community appears to be susceptible to bracken and rhododendron invasion. The former is a natural component but should not exceed 25% cover; the latter is an invasive non-native and should be eradicated. Pine and birch invasion is common but is largely controlled to within acceptable levels (<5% tree or tree seedling cover) by the prescribed burning programme.

Qualifying Feature equivalent

Accommodated within the Annex I habitat *European dry heaths.*

Distribution and extent of H2a

This very dry heath is very extensive on the dry acid sands of the Dorset heathlands but relatively restricted in the New Forest. No absolute area figure for this community has been assessed.

H2c: Heather-Dwarf Gorse Heath-Purple Moor-grass subcommunity (*Calluna vulgaris-Ulex minor* heath-*Molinia caerulea* subcommunity)

A similar community to H2a, dominated by *Calluna vulgaris*, but characteristic of moister slightly richer soils (slowly permeable gley podzols) which are wet enough to support *Molinia* and scattered *Erica tetralix,* but not wet enough to exclude *E. cinerea*. In addition*, Agrostis curtisii* and *Deschampsia flexuosa* are absent and bracken relatively uncommon.

Again, the physical structure of the community and the relative abundance of *Erica cinerea* (and *E. tetralix)* is dependent upon the successional stage reached since the last burn. As for H2a, greatest biodiversity will be found where a structural mosaic of heather is present over the community as a whole. In this case however burning does result in an early flush of *Molinia* for one to three years followed by reestablishment of first *Erica cinerea* and *E. tetralix*, followed by *Calluna*. Indeed, burning and grazing are absolutely crucial to maintaining this community which would otherwise become dominated and greatly impoverished by *Molinia.* This species is currently controlled and grazed tight by commoners' animals.

The community is less susceptible to bracken invasion due to wetter soils but rhododendron invasion and spread of pine and birch are constant management issues.

Qualifying Feature equivalent

Accommodated within the Annex I habitat *European dry heaths.*

Distribution and extent of H2c

No absolute area figure for this community has been assessed.

H3c: *Agrostis curtisii* subcommunity

This dry heath is characterised by the presence of abundant *Agrostis curtisii* and the absence of *Erica tetralix* for which soils are too dry. *Calluna vulgaris* generally dominates mature stands with *Erica cinerea* cover dependent upon the successional stage reached since the last prescribed burn. Common associates are *Molinia* (for which soils are wet enough), *Ulex minor* (restricted by hard grazing) and *Viola lactea*, with occasional *Potentilla erecta* and *Polygala serpyllifolia*. The abundance of *Ulex europaeus*, particularly on previously disturbed ground is particularly characteristic.

This community is intermediate in soil moisture preference between the driest H2a and the moister H2c communities. It occurs on acidic slightly gleyed podzols which though impoverished are not as extreme as those soils supporting the driest heath community (H2a).

Once again prescribed burning profoundly affects the physical structure and relative

abundance of the key species. In this case *Agrostis curtisii* with its prolific seeding ability rapidly spreads onto bare ground along with *Molinia* in the early stages following a burn when the community has the outward appearance of acid grassland (U3).

Qualifying Feature equivalent

Accommodated within the Annex I habitat *European dry heaths*

Distribution and extent of H3c

No absolute area figure for this community has been assessed though it dominates areas such as Beaulieu Heath West on drier soils.

H3a: Dwarf Gorse-Bristle Bent heath-Typical subcommunity (*Ulex minor-Agrostis curtisii heath*-Typical subcommunity)

Characterised by the presence of *Calluna vulgaris, Erica tetralix, E. cinerea, Molinia caerulea* and *Agrostis curtisii* in varying amounts depending upon the stage in the prescribed burning cycle. Soil moisture is sufficient to support *Erica tetralix* and *Molinia* but not wet enough to exclude *E. cinerea*. Dwarf shrubs tend to dominate over the grasses which occur as scattered clumps among the shrub canopy; *Molinia* in particular being controlled by grazing.

Qualifying Feature equivalent

Accommodated within the Annex I habitat *European dry heaths.*

Distribution and extent of H3a

No absolute area figure for this community has been assessed.

H3b: Dwarf Gorse-Bristle Bent heath-*Cladonia* subcommunity (*Ulex minor-Agrostis curtisii heath-Cladonia* subcommunity)

This community is more open than H3a—and the mosaic of grass to dwarf-shrub is more equitable. It is notable for the abundance of common *Cladonia* type lichens on the more exposed areas. These include *Cladonia impexa, C. floerkeana, C. coccifera* and *C. pyxidata.* However, it should be noted that competition with *Agrostis curtisii* restricts bryophytes and lichens and H3 communities can be relatively poor compared to suitably managed H2 communities.

Qualifying Feature equivalent

Accommodated within the Annex I habitat *European dry heaths*

Distribution and extent of H3b

No absolute area figure for this community has been assessed.

Additional dry heath community: *Calluna vulgaris-Molinia caerulea-Erica tetralix-Leucobryum glaucum* heath (Sanderson, 1988)

In the New Forest there is a fairly extensive community which occupies a zone between the dry heath communities described above and wet heath. It is characterised by the presence of *Calluna vulgaris, Erica tetralix, Molinia caerulea* and the moss *Leucobryum glaucum*, in the absence of both *Erica cinerea* for which soils are too wet and sphagna for which they are too dry. It marks the division between the drier podzols on which communities are eventually dominated by *Calluna* in the later successional stages of the prescribed burning cycle, as well as the wetter humic gleys and stagnogleys on which heather is present but never achieves the same dominance. On heathlands elsewhere (and incidentally where the bulk of NVC quadrat samples were taken), where the clay content of soils is less and hence soil water is less impeded, this ‘humid heath’ zone tends to be very narrow and much less significant, while the separation between dry and wet heath is very sharp.

In the New Forest the distinction between wet heath and this true ‘humid heath’ community is maintained by grazing and prescribed burning. This management effectively suppresses *Molinia* dominance which in wet heath would overwhelm and eventually kill sphagna and (among other things) obscure the zonation of the vegetation.

Qualifying Feature equivalent

Accommodated within the Annex I habitat *European dry heaths.*

Distribution and extent of *Calluna vulgaris-Molinia caerulea-Erica tetralix-Leucobryum glaucum* heath

There is an estimated 4,000ha of this community type in the New Forest.

New Forest wet heath: description

The New Forest wet heaths comprise a suite of vegetation communities defined by soil moisture, nutrient and base status—these are profoundly influenced by prescribed burning and grazing. Soils are too dry to sustain the large peat-building sphagna associated with mires (e.g. *Sphagnum papillosum* and *S. magellenicum*) but too wet to support *Erica cinerea*. There is no real dominance by *Calluna vulgaris* as generally occurs in the later successional stages following burning on dry heaths.

In terms of the NVC there are three main subcommunities of M16 Wet Heath: M16a, M16b and M16c. There is also a more base-rich and extreme form of M16b occurring locally on marl in the New Forest. These embrace the 'wet heath' of the Westerhoff and Clarke vegetation survey (1998) and the 'wet heath' (which corresponds to M16a, M16c) and 'tussock heath' (which corresponds to M16b) of Tubbs (1986).

Two Annex I habitats under the Habitats Directive are present:

1. Northern Atlantic wet heaths with *Erica tetralix*-incorporates M16a and M16b

2. Depressions on peat substrates (*Rhynchosporion*)-incorporates M16c.

Wet heath community descriptions

Wet heath communities occur on nutrient-poor mineral soils or very shallow peats that are at least seasonally waterlogged but may be surface dry in summer. Stands managed by prescribed burning and grazing will have the highest biodiversity and display a structural mosaic of *Erica*ceous species, with up to 5% bare peaty soil in an intimate mosaic with the vegetation. At least 25% cover is provided by ericoid shrubs (*Calluna vulgaris* and *Erica tetralix*) and a further minimum of 20% cover by sphagna. Cover values below this for these groups will be indicative of either *Molinia* dominance (caused by a lack of burning and grazing management) or artificial drainage which has lowered the water table and excluded *Sphagnum* growth. Drainage may also encourage the spread of *Myrica gale* and even *Ulex europaeus. Molinia* cover will be variable depending on grazing pressure but should not exceed 50% in scattered tussocks.

Invasion by rhododendron, pine and birch present management issues. Rhododendron should be below 1% cover and tree seedlings or tree cover should be kept below 5% cover. There is an estimated 2,100ha of wet heath in the New Forest. Its distribution is shown on Map 5 at the end of this document.

M16a: Cross-leaved Heath-*Sphagnum compactum* wet heath-typical subcommunity (*Erica tetralix-Sphagnum compactum* wet heath-typical subcommunity)

Characterised by the presence of *Calluna vulgaris, Erica tetralix* and *Molinia caerulea* in varying amounts and degrees of dominance depending upon water levels and management regime. It is interesting to note that *Calluna* never reaches the dominance that it has on dry heath, presumably because of the competitive advantage which *Erica tetralix* has in the wetter conditions where it reaches its highest cover values, provided *Molinia* is kept in check by grazing. The principle sphagna cover is provided by *Sphagnum compactum*, a relatively small species which prefers drier situations and *Sphagnum tenellum* in wetter hollows. Other sphagna e.g. *Sphagnum cuspidatum, S. auriculatum* sometimes occur in wetter situations. Lichens, particularly the wet heath specialists *Cladonia strepilis* and *Pycnothelia papillosum,* can be frequent. The most frequent vascular associates are *Trichophorum cespitosum* and *Juncus squarrosus*, with occasional *Narthecium ossifragum* and *Eriophorum angustifolium* as the community merges into mire.

Qualifying Feature equivalent

Accommodated within the Annex I habitat *Northern Atlantic wet heaths with Erica tetralix*

Distribution and extent of M16a

The most extensive form of wet heath on the poorer soils characteristic of the northern half of the Forest, occupying around 1,050ha of the total 2,110ha.

M16b: Cross-leaved Heath-*Sphagnum compactum* wet heath-Devil's-bit Scabious-Carnation Sedge subcommunity (*Erica tetralix-Sphagnum compactum* wet heath-*Succisa pratensis-Carex panicea* subcommunity)

This community is generally of a more tussocky nature due to the steady movement of surface water and considerably more herb-rich than M16a due to the richer underlying soils which may exceed pH 5 in some cases. (There is an extreme base-rich variant of this community not described in the NVC occurring very locally in the Forest which overlies the Headon beds, which Sanderson (1988) has called 'calcareous tussock heath'.) Among the *Molinia* tussocks, typical associates include *Potentilla erecta* and *Succisa pratensis* with *Polygala serpyllifolia, Carex panicea, Cirsium dissectum* and *Serratula tinctoria*. Other notable species are *Genista anglica, Achillea ptarmica* and *Salix repens,* as well as the nationally scarce *Gentiana pneumonanthe*. The more acidic species (*Trichophorum cespitosum*, *Narthecium ossifragum* and *Eriophorum angustifolium*) are less frequent in this community, as are *Sphagnum compactum* and *S. tenellum*. These species tend to be replaced by *Sphagnum auriculatum* which is more frequent here than in any other M16 community.

Qualifying Feature equivalent

Accommodated within the Annex I habitat *Northern Atlantic wet heaths with Erica tetralix*

Distribution and extent of M16b

Of the total 2,110ha of wet heath present in the Forest it is estimated that less than 840ha is M16b. Extensive tracts occur on slopes throughout the Forest.

M16c: Cross-leaved Heath-*Sphagnum compactum* wet heath-White beak sedge-Oblong-leaved Sundew subcommunity (*Erica tetralix-Sphagnum compactum* wet heath-*Rhynchospora alba-Drosera intermedia* subcommunity)

A more open community characterised by a reduced cover of *Calluna vulgaris, Erica tetralix* and *Molinia caerulea*, as well as an extensive cover of *Sphagnum compactum* and *S. tenellum* with other mosses including *Campylopus brevipilus* and *C. introflexus* among the vascular associates *Trichophorum cespitosum* and *Juncus squarrosus*. Wetter hollows and runnels support *Drosera rotundifolia* and the rarer *D. intermedia* which is a particularly distinctive feature of this community. Bare peat is colonised by the local *Rhynchospora fusca* and the club moss *Lycopodiella inundata.*

Qualifying Feature equivalent

Accommodated within the Annex I habitat *Depressions on peat substrates* (*Rhynchosporion*)

Distribution and extent of M16c

It is estimated that about 10% of the wet heath is M16c which gives an area of about 210ha.

New Forest mires: description

The New Forest mires comprise a suite of communities which are described under the generic headings of *Valley Bogs, Bog Pools, Soakways, Poor Fen, Moorgrass Mires, Marl Flushes* and *Transition Mires* (Sanderson, 1998). In terms of the National Vegetation Classification the first five of these are directly referable to M21a, M1, M29, M6di and M25a respectively. The Marl Flush communities are neither well sampled or described in the NVC but can be divided between M10a and M14. The Transition Mires are closely related to M9 but carry vegetation transitional to M29 and M1.

Mire is a generic term used here to encompass the variation in vegetation which in the New Forest is really a combination of bog and fen in the classic sense (NCC, 1989; Fojt, 1994). Bogs are typically rain-fed, mineral and nutrient-poor and acidic. Fens are groundwater fed, have a higher nutrient status (mesotrophic to eutrophic) and are generally neutral or alkaline. New Forest mires have elements which are typical of both bogs and fens. For example, typical bog vegetation of acid sphagna and associates *Narthecium ossifragum*, *Eriophorum angustifolium* and *Rhynchospora alba* occur in ground water fed mires in the New Forest.

This gives rise to difficulties in evaluating mire communities at the European level (see Part 3). The bulk of the Forest mire communities fall within NVC community M21a: *Narthecium ossifragum-Sphagnum papillosum* Valley Mire-*Rhynchospora alba-Sphagnum auriculatum* subcommunity, in ground water fed situations, a vegetation type simply not recognised in the Corine classification or the Qualifying Feature. However, three individual components of valley bog complexes are recognised in the Directive as follows (and clearly none of these could exist in isolation out with the valley bogs and wet heaths in the New Forest).

Qualifying Feature Annex I habitats

- Alkaline fens
- Depressions on peat substrates of the *Rhynchosporion*
- Transition mires

Historically the general pattern of variation in lowland mire vegetation was described in a pioneering account by Rose (1953) and specifically for the New Forest by Tubbs (1986). Newbould (1960) provides detailed information on the vegetation and ecology of Cranes Moor and a Nature Conservancy Council vegetation survey of 23 valley mires (Alcock, 1984) has been related to the NVC by Sanderson (1998). Wheeler (1980) mentions the base-rich seepage mires in the southwest of the Forest. Clarke provides a detailed summary of the ecology and history of the mires including the first observations on the vital importance of grazing in maintaining the richer communities (Rowell and Clarke, 1988). While many of these authors used inventive classifications to describe the variation in New Forest mires, this document, for clarity and to aid meaningful comparative evaluations, describes them under their generic headings by use of the NVC.

The variation in vegetation composition in New Forest mires is attributable to a number of related factors. The most important are acidity determined by underlying soils, hydrology, nutrient status and management—particularly grazing and prescribed burning pressure. The structural variation is very wide, and each mire system is unique.

Origin and form of New Forest valley mires and seepage step mires

New Forest mires occur as either seepage step mires or valley mires. Tuckfield (1973) describes the distribution, form and development of New Forest seepage steps. Clarke (1988) builds upon the earlier works of Rose and Newbould to describe the origins of valley mires and the ecology of their communities. Tubbs (1986) describes the relationship of the two mire types and the surrounding heathland vegetation in a simple diagram which is reproduced below.

Valley mires form in valley bottoms with low hydraulic gradients and impermeable subsoils where springs or spring lines arise, allowing peat accumulation. Wide, shallow valleys with slight gradients support extensive mires; narrow, steep valleys support smaller, more localised mires. The distribution of the various plant community types described below is in part related to water chemistry and nutrient status. This in turn is dependent upon the base status of the parent material from which the soil water derives in the New Forest ground water-fed valley mires. Hence, the central flows of valley mires which receive water from the Headon Beds may be neutral or slightly alkaline. Those fed from sands and gravels are acidic.

This effect is most concentrated along the axis of flow and increases downstream. In addition, this produces a further gradient of declining nutrient status and increasing acidity across valley mires from the central axis. Vegetation communities develop along these gradients, classically from enriched fen and carr along the axis to increasingly acidic *Sphagnum* bog communities peripherally.

Seepage steps form on valley sides where ground water concentrates above the junction between a permeable sandstone and an underlying impermeable clay. Subsequent erosion produces a characteristic profile in which there is a steep scarp slope above the seepage and a zone of slumped material below it, the mire forming in water retentive hollows of the undulating slope.

There are around 2,020ha of mire in the New Forest. Its distribution is shown on Map 6 at the end of this document.

Mire plant community descriptions

Valley bogs

Mires dominated by stands of robust, peat-forming *Sphagnum* spp. which can be extensive

and luxuriant, especially *Sphagnum papillosum* and *S. magellanicum* with typical acid bog species such as *Narthecium ossifragum*, *Eriophorum angustifolium* and *Rhynchospora alba*. *Molinia caerulea* is a constant but is held in check by the low aeration capacity of stagnant or very slow flowing water and grazing.

National Vegetation Classification

Valley bog vegetation is accommodated within M21a.

M21a Bog Asphodel-Bog Moss Valley Mire-White beak sedge-Bog Moss subcommunity (*Narthecium ossifragum-Sphagnum papillosum* Valley Mire-*Rhynchospora alba-Sphagnum auriculatum* subcommunity)

This is the most abundant community, occurring extensively in both valley and seepage step localities, on permanently waterlogged, nutrient-poor (oligotrophic) acidic peats (pH 3.5-4.5). In addition to the dominant *Sphagnum papillosum*, other frequent sphagna include *Sphagnum subnitens*, *S. auriculatum, S. capillifolium* and *S. recurvum*. Common associated species include *Drosera rotundifolia, Erica tetralix, Menyanthes trifoliata, Potamogeton polygonifolious* and locally, *Myrica gale*. A significant proportion of the British population of *Hammarbya paludosa* is found here. In contrast to the description provided in the NVC *Schoenus nigricans* may be locally dominant in New Forest seepages which otherwise lack the brown mosses characteristic of more base-rich Marl Flush communities.

The bryophyte flora is especially rich featuring many bog specialist liverworts including *Calypogeia sphagnicola, Cephalozia macrostachya, Cladopodiella fluitans, Kurzia paucifonious, Mylia anomala, Odontoschisma sphagni* and *Riccardia latifrons*.

Water quality in the catchment is vital—and any significant eutrophication would change the community over time to poor fen. Well grazed mires have between 1-10% bare peaty ground in an intimate mosaic with the vegetation. Water levels are consistently high, with the mire being soft and wet all year round with natural shallow runnels, soakways and water tracks in larger systems. Another characteristic of New Forest mires is that peat development is extremely slow compared to upland bogs, typically accumulating at a rate of 20cm per 1,000 years (Clarke, 1988). Consequently peat depths are shallow and rarely in excess of 2m. This makes them particularly vulnerable to damage from artificial drainage which results in rapid headward erosion and lateral peat slumping. Changes in vegetation around such damaged areas become apparent with species indicative of drying conditions such as pine and birch, or species indicative of lower water levels and faster flows such as *Molinia* and *Myrica* becoming more abundant and creating management problems. In particularly serious cases *Sphagnum* spp. cover becomes very much reduced, to less than 10% in some cases.

Habitat Directive equivalent

Depressions on peat substrates of the Rhynchosporion occurs in complex habitat mosaics associated primarily with the extensive valley bogs.

Depressions on peat substrates of the Rhynchosporion occur in complex mosaics with lowland wet heath and valley mire vegetation, in transition mires and on the margins of bog pools and hollows in both raised and blanket bogs. The vegetation is typically very open, usually characterised by an abundance of white beak sedge *Rhynchospora alba*, often with well-developed algal mats, the bog moss *Sphagnum denticulatum*, round-leaved sundew *Drosera rotundifolia* and, in relatively base-rich sites, brown mosses such as *Drepanocladus revolvens* and *Scorpidium scorpioides*. The nationally scarce species brown beak-sedge *Rhynchospora fusca* and marsh clubmoss *Lycopodiella inundata* also occur in this habitat. The New Forest, one of three sites selected in southern England, is considered to hold the largest area in England of *Depressions on peat substrates of the Rhynchosporion*, in complex habitat mosaics associated primarily with the extensive valley bogs of this site. The habitat type is developed in three situations: in natural bog pools of patterned bog surfaces, in flushes on the margins of valley mires and in areas disturbed by peat-digging, footpaths, tracks, ditches, etc. In places the habitat type is rich in brown mosses *Cratoneuron* spp. and *Scorpidium scorpioides*, suggesting flushing by mineral-rich waters. The mosaics in which this habitat type occurs are an important location for bog orchid *Hammarbya paludosa*.

Distribution and extent

Forms most of the coverage at around 4,000ha**.**

Bog pools

Many of the larger valley bogs support bog pools, where low flows or stagnant water, high acidity (pH around 3.5-4.4) and very low nutrient levels (dystrophic conditions), support carpets of sphagna with scattered vascular plants growing through or among them. In more accessible situations many are thought to have been derived from old peat cuttings.

National Vegetation Classification

Bog pool community is accommodated within M1.

M1: *Sphagnum auriculatum* bog pool community

The dominant sphagna are *Sphagnum auriculatum* and *S. cuspidatum*. The commonest vascular plant is *Menyanthes trifoliata, Rhynchospora alba* and *Eriophorum angustifolium*,

but the bog pools are also localities for some very local species including *Utricularia minor, Drosera anglica, Rhynchospora fusca* and *Carex limosa.*

This is one of the very few communities in the New Forest which can sustain its botanical interest in the absence of grazing, a factor associated with the inaccessibility of many of the bog pools in the larger mires.

Qualifying Feature equivalent

Depressions on peat substrates of the Rhynchosporion, the habitat type is developed in situations such as in natural bog pools of patterned bog surfaces. See above.

Distribution and extent

Less than 1% cover (of the New Forest SAC) distributed over M21a communities.

Soakways

Communities dominated by *Hypericum elodes* and *Potamogeton polygonifolius* associated with the natural drainage systems of valley mires, invariably marking areas of slow water movement within low fertility mires, usually less acidic than M21a (pH 4-5.5). They may be seasonally inundated or permanently wet.

National Vegetation Classification

Soakways community is accommodated within M29.

M29: Marsh St John's wort-Bog pondweed soakway (*Hypericum elodes-Potamogeton polygonifolius* soakway).

The linear creeping mats of *Hypericum elodes* and *Potamogeton polygonifolius* are highly distinctive, often accompanied by *Ranunculus flammula* and *Juncus bulbosus*. Typical associates include a range of bog or poor fen plants including *Sphagnum auriculatum, Hydrocotyle vulgaris, Anagallis tenella, Drosera rotundifolia, Narthecium ossifragum, Carex rostrata, Baldellia ranunculoides, Pedicularis palustris* and *Galium palustre*. The presence and abundance of these species is dependent upon the degree of animal grazing and poaching; and whether the soakway is permanently or seasonally wet. For example, *Carex rostrata* and *Pedicularis palustris* are confined to permanently wet stands and *Baldellia ranunculoides* is typical of seasonally wet stands. *Utricularia intermedia* is a particularly notable species in the large (though regrettably reduced), M29 stands in Denny Bog.

The soakway community is highly dependent upon grazing and in all but the most flooded

areas will be replaced by M25 if grazing is reduced to low levels.

Qualifying Feature equivalent

The permanently wet stands in some mires are accommodated within Annex I habitat *Transition mires and quaking bogs* (Tratt et al, 2013)**.**

Distribution and abundance

Less than 1% cover (of the New Forest SAC) associated with the natural drainage systems of pristine mires. This community has been the natural focus of attempts to increase water run-off from mires and so many soakways have been damaged by drainage schemes.

Poor fen

This mire type supports *Sphagnum* dominated communities, but they are composed of species which are tolerant of higher nutrient status than the 'valley bog' situation. Soils are consistently waterlogged and acidic (pH 4.5-5.5) and water flow is modest.

National Vegetation Classification

Poor fen vegetation is accommodated within M6di.

M6di: Star sedge-Bog moss mire-Sharp-flowered rush subcommunity (*Carex echinata-Sphagnum recurvum* Mire-*Juncus acutiflorus* subcommunity-*Sphagnum recurvum* variant)

Sphagnum recurvum is the dominant *Sphagnum* species and those associated with more acidic and nutrient-poor situations are absent (e.g. *S. papillosum, S. auriculatum* and *S. cuspidatum*). *Juncus acutiflorus* is constant but controlled (like *Molinia*) by grazing. Typical poor fen associates include *Agrostis canina*, *Carex echinata, Epilobium palustre* and the mosses *Sphagnum palustre* and *Polytrichum commune*. While the flora is less striking than other mire types, the community provides a locus for *Viola palustre* and *Carex curta* in the New Forest.

Poor fens are well grazed and as with valley bogs provide commoners' stock with an early spring bite and essential grazing in droughts. Birch and willow invasion can change the community over time to carr NVC community W4b: *Betula-Molinia* Mire. Drainage is apparent on the northern commons.

Qualifying Feature equivalent

None.

Distribution and abundance

No absolute area figure for this community has been assessed though it is typical of valley mires in the central woodland pasture complex, where leaf wash into the mire may raise the nutrient status and on the northern commons.

Moor-grass mires

These are mires with higher levels of water movement and reduced grazing levels producing ideal conditions for rapid *Molinia* growth and dominance. This species together with *Myrica gale* effectively suppress other less competitive species producing a rather floristically impoverished community. (The greater structural diversity created by reduced grazing may however be important for some invertebrate species less tolerant of high grazing levels.) All New Forest mires with sufficient water flow have the capacity to degenerate to moor-grass mire if grazing were reduced sufficiently. Equally, moor-grass mires will revert to more floristically-rich communities if grazing levels (and maybe some prescribed burning) increase.

National Vegetation Classification

Moor-grass vegetation is accommodated within M25a.

M25a: Purple moor-grass-Tormentil mire-Cross-leaved heath subcommunity (*Molinia caerulea-Potentilla erecta* mire-*Erica tetralix* subcommunity).

Dominated by *Molinia caerulea* and when grazing levels are particularly low, tussocks will form and litter build becomes significant, further impoverishing the flora. Particularly poor stands characteristic of ungrazed heathland elsewhere are rare in the New Forest as most stands, except the most inaccessible, receive at least some periodic light grazing. Associated species are restricted mainly to *Myrica gale, Juncus acutiflorus, Potentilla erecta* and *Erica tetralix.*

Qualifying Feature equivalent

None.

Distribution and abundance

No absolute area figure for this community has been assessed though this community dominates some of the very wet valley mires in the south of the Forest and in under-grazed situations between Burley and Bolderwood, but otherwise is of rather local occurrence.

Marl flushes

Seepage step communities and highly flushed areas in valley mires with shallow peat but sufficient base enrichment to support brown mosses and more base demanding vascular plants. The most striking are those found in seepage step mires on marl (lime-rich clay) producing water so base-rich (pH 7.0 or higher) that tufa is deposited on the mosses. However, less strongly lime-enriched flushes (pH 6-6.5) without tufa deposition are more frequent. *Schoenus nigricans* may be present or absent in all variants.

National Vegetation Classification

Accommodation of the Forest marl flushes within the NVC is not straightforward, probably due to a lack of sampling the full variation in Forest mire communities. The less base-rich stands with *Schoenus nigricans* can be accommodated within M14 but *Schoenus* is more often absent than present in Forest marl flushes. The highly lime-rich marl flushes have no real NVC equivalent but are closest to the upland M10a community.

The following classification suggested by Sanderson (1998) is adopted here:

'*Eleocharis quinquefolia-Drepanocladus revolvens* mire' a lowland form of NVC Community: M10a: *Carex dioica-Pinguicula vulgaris* mire-*Carex viridula oedocarpa-Juncus bulbosus* subcommunity.

Highly lime-rich marl flushes, pH around 7.0 or higher, depositing tufa, with lime-loving species prominent. The presence of *Eleocharis quinquefolia*, the brown moss *Cratoneuron commutatum* and the abundance of the brown moss *Drepanocladus revolvens* are diagnostic. Variants with and without *Schoenus nigricans* exist, those with *Schoenus* tend to be larger and wetter mires. Associated species include *Carex panicea, Carex hostiana, Anagallis tenella, Succisa pratensis, Pedicularis sylvatica, Scutellaria minor* and *Briza media. Molinia* is constant but held in check by tight grazing. These marl flushes support a very rich flora including notable species such as *Eriophorum latifolium*, *Pinguicula vulgaris* and the bryophytes *Cratoneuron commutatum, Philonotis calcarea* and *Preissia quadrata. Pinguicula lusitanica* is more abundant in these flushes than in other mire types elsewhere.

'*Eleocharis* spp.-*Campylium stellatum* mire-*Narthecium ossifragum-Drosera rotundifolia* subcommunity', which incorporates the NVC community: M14 *Schoenus nigricans-Narthecium ossifragum* mire.

Less lime-enriched marl flushes, pH around 6-6.5, non-tufa depositing with strongly lime loving species absent. The only abundant brown moss is *Campylium stellatum* with *Drepanocladus revolvens* rare and with *Eleocharis quinquefolia* replaced by *Eleocharis multicaulis*. Species characteristic of more acidic mires are more evident including *Narthecium ossifragum* and *Drosera rotundifolia*. Variants with *Schoenus nigricans* are accommodated within M14. Associated species include *Juncus acutiflorus, Carex panicea* and *Erica tetralix*. Again, *Molinia* is constant but held in check by grazing.

Qualifying Feature equivalent

The *'Eleocharis quinquefolia-Drepanocladus revolvens* mire*'* a lowland form of NVC Community: M10a: *Carex dioica-Pinguicula vulgaris* mire-*Carex viridula oedocarpa-Juncus bulbosus* subcommunity is included within the Qualifying Feature habitat: Alkaline Fen**.** The *'Eleocharis* spp.-*Campylium stellatum* mire-*Narthecium ossifragum-Drosera rotundifolia* subcommunity', which incorporates the NVC community: M14 *Schoenus nigricans-Narthecium ossifragum* mire is included in the Qualifying Feature: Transition mires and quaking bogs.

Distribution and abundance

No absolute area figure for this community has been assessed. Most stands are small valley side seepage step mires scattered across the south of the Forest but Stony Moors has an exceptionally large example which has suffered damage from drainage and consequent scrub invasion.

Transition mires

H7140 Transition mires and quaking bogs: Very wet mires often identified by an unstable 'quaking' surface. The term 'transition mire' relates to vegetation that in floristic composition and general ecological characteristics is transitional between acid bog and 7230 Alkaline fens, in which the surface conditions range from markedly acidic to slightly base-rich. The vegetation normally has intimate mixtures of species considered to be acidophile and others thought of as calciphile or basophile. In some cases the mire occupies a physically transitional location between bog and fen vegetation, as for example in association with certain valley and basin mires. In other cases these intermediate properties may reflect the actual process of succession, as peat accumulates in groundwater-fed fen or open water to produce rainwater-fed bog isolated from groundwater influence.

In the New Forest, transition mires occur on deep, waterlogged peats which are irrigated by base-rich water and support brown mosses and tall sedges but *Schoenus nigricans* is never present. These are particularly notable for the rare species which they support.

National Vegetation Classification

Transition mire vegetation is closely related to M9 but there is a great degree of variation and many stands are transitional to other NVC communities as described by Sanderson (1998). For example, M14 and M29 are now included in this feature; they are described separately elsewhere.

M9: *Carex rostrata-Calliergon cuspidatum/giganteum* mire

A variable community characterised by the presence of *Calliergon cuspidatum* and *Carex rostrata* with various brown mosses and base-tolerant mosses. Sphagna, apart from the more base-demanding species, are rare and in the New Forest communities *Schoenus* is absent. Communities associated with M9 provide a locus for several rare specialist mire species including *Eriophorum gracile, Carex limosa, C. lasiocarpa, Sphagnum contortum, S. teres, S. subsecundum, Pedicularis palustris, Drosera anglica, Utricularia minor, Pressia quadrata, Calliergon giganteum* and *Philonotis calcarea*. Sanderson (1998) identifies the following community stand types:

'*Carex limosa/C. lasiocarpa-Sphagnum contortum/teres* stands' transitional between NVC community M9a: *Carex rostrata-Calliergon cuspidatum* Mire-*Campylium stellatum-Scorpidium scorpioides* subcommunity. M1 *Sphagnum auriculatum* bog pools: Found in mildly base-enriched, very swampy areas in the southwest of the Forest in places such as Wilverley, Holmsley and Burley Common moor. Characterised by the presence of one or both of *Carex limosa* and *C. lasiocarpa* along with the base demanding bog mosses *Sphagnum contortum* and *S. teres*.

'Carex rostrata-eriophorum gracile stands' transitional between NVC community M9a and M29: Marsh St John's wort-Bog pondweed soakway (*Hypericum elodes-Potamogeton polygonifolius* soakway): found in a base-enriched area in Fort Bog, east of the Forest.

Marl swamps

Closer to NVC community M9b: *Carex rostrata-Calliergon cuspidatum* Mire-*Carex diandra-Calliergon giganteum* subcommunity but lacks *Carex diandra*.

Qualifying Feature equivalent

M9 stands are referable to Qualifying Feature: transition mires.

Distribution and abundance

Generally confined to areas within valley mires where artesian sources of base-rich water produce very wet swampy conditions. Given the variability apparent in transition mires an area figure for this feature is not available to date. The community is widely adversely affected by drainage, enclosure for forestry and carr invasion on the Open Forest.

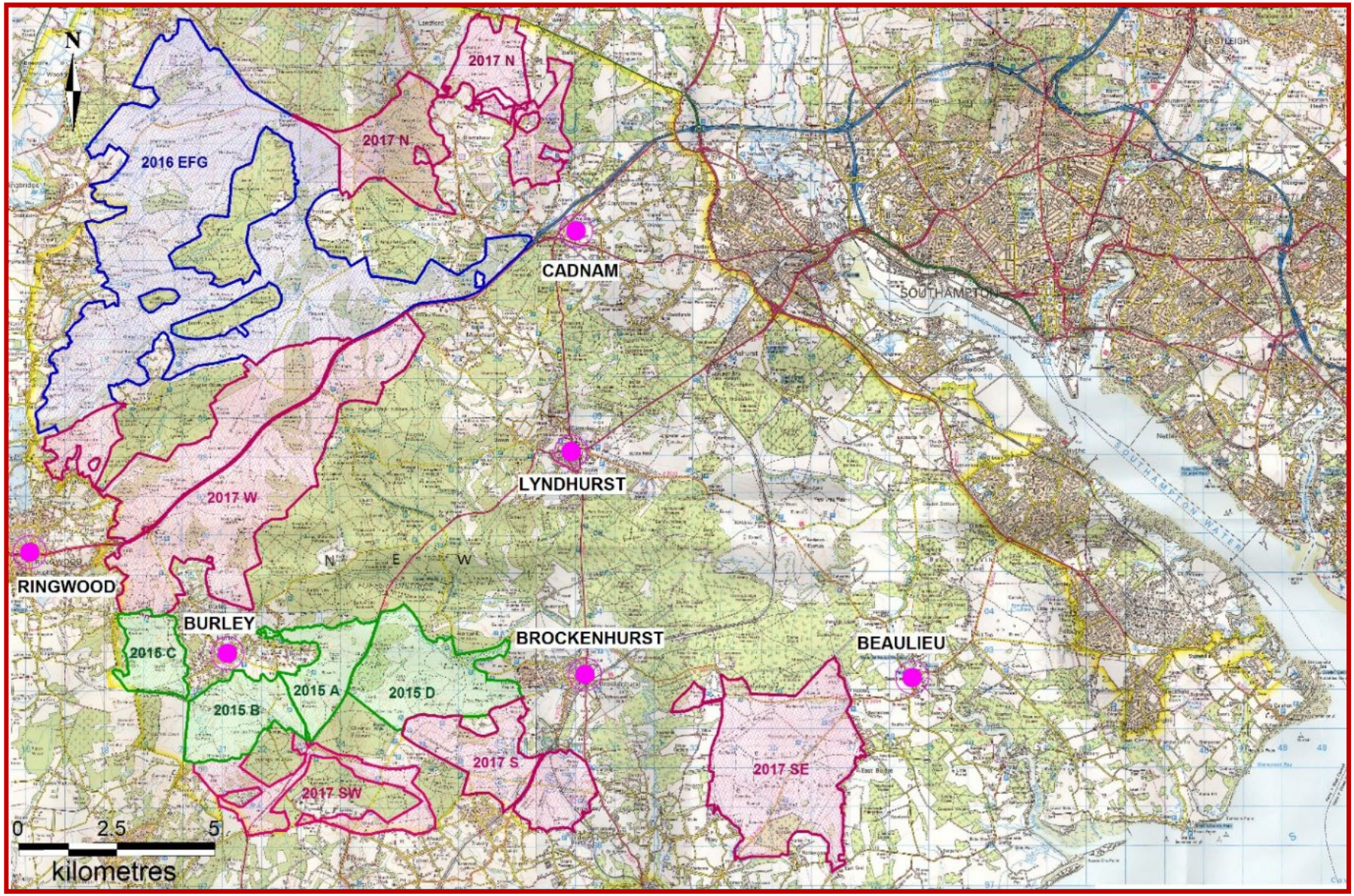
New Forest mire survey

Natural England has recently commissioned extensive survey of the New Forest mires (Meade, 2018). The aim of the work was to identify the locations of the mires, map their outlines and use the NVC plant community classification ultimately to place each mire into a Natura 2000 habitat type and the relevant UK BAP Priority Habitat. Although fieldwork has taken the location and characterisation of the mires as the main priority, the same visits have been used to compile plant species lists for the main mire habitat dominants and to approximate the boundaries of the non-wetland habitats as bespoke categories to account for all land within the survey area.

While there is not yet full coverage the results so far have improved our understanding of the distribution, complexity in terms of community types and eco-hydrological relationships of the mire systems in the various catchments of the New Forest. The map below shows the areas covered by the surveys carried out between 2015 and 2017, as well as the area yet to be commissioned around Beaulieu. It is strongly recommended that this work is enabled to complete the coverage of this important work.

For the purposes of this Management Plan only the briefest summary of the various NVC and Corine equivalents is given, both for the individual areas surveyed and then total areas. This at least gives an idea of the complexity and variation of the New Forest mires and their importance at the European level. The reader is recommended to refer to the individual reports produced by Dr Roger Meade for a full description of any individual mire, its characteristics condition and rare species.

Figure B: Map of mire survey areas 2015-2017



2017 north sites (the northern commons)

It has a varied vegetation cover, open in the north but with beech plantation over much of the land in the south. It is geologically diverse, with a sequence of Wittering Formation-Earnley Sands-Marsh Farm Formation in the north and of Selsey Sands and Barton Clays in the south.

The northern part (e.g. Plaitford and West Wellow Commons) are heavily grazed in comparison with the south and support a mosaic of acid grassland, dry heath and wet heath. Wetlands occur mostly at the base of slopes at the edges of the site. In the south, wetlands are more widely distributed with some evidence of base-enrichment in widespread *Molinia* fen-meadow and a very small area of alkaline fen.

Table 10: European sites Qualifying SAC Features: northern commons

Annex I feature	NVC communities or habitat	Area (ha)
Alkaline Fen	M10a, M13a	0.20
Transition Mire and Quaking Bog Type 2	M6, M29	17.90
Transition Mire and Quaking Bog Type 2 speculative	M25a	29.15
Transition Mire and Quaking Bog Type 5	M21a, M21b	14.07
Molinia Meadows	M24c	9.36
North Atlantic Wet Heath	Wet heath	34.05
European Dry Heath	Dry heath + *Molinia*-rich dry heath	74.95

2016 Wilverley North Mires (around Burley)

Of the Natura 2000 types, Code 7140 Transition Mire is well-represented, though as white beak sedge *Rhynchospora alba* is abundant this may also represent 7150 Depressions in peat substrates with *Rhynchospora*. No 7230 Alkaline Fen was found on this study area. Code 4010 North Atlantic Wet Heath and 4030 European Dry Heath also occupy large areas, the dry heath being particularly widespread. BAP Priority Habitats include Lowland Fen, Lowland Heathland, Lowland Dry Acid Grassland, Rivers and areas of Wet Woodland.

Reference to the geological map shows that most of the hillside slope discharges occur close to the local groundwater level suggesting the ‘bottoms’ lie within highly porous strata without the intervention of aquitards. The whole is mapped as Barton Sands, which includes the more recently recognised Becton Sand. The lack of plants indicating base-enrichment of the water supports the interpretation that groundwater is largely derived from an acidic sandy source and does not involve either the Chama Sand or Barton Clay, both associated

with base-enrichment on some other study areas.

The botanical diversity in this study area is evenly spread except from a rather more diverse seepage midway along the Duckhole Bog sequence of mires that supports a few tussocks of black bog-rush and the rarities marsh clubmoss and marsh gentian.

Table 11: Indicative areas for European Sites Qualifying SAC Features from NVC and other polygons for Wilverley North Mires around Burley

Natura 2000		Subcategory (Report 5)	Indicative NVC	Caveats	Group A sites	
Code	Title				Area (ha)	NVC or type
7140	Transition Mire	Water flow tracks TMGB/2	(M9), M14, M29		5.94	M29 & mosaics
		Soligenous or rheotopogenous bog/oligotrophic base-poor mire TMQB/5	M21		31.26	M21a
6410	*Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)		M24, M26		2.14	M24c
7150	Depressions in peat substrates with *Rhynchospora*		M21, M1, M2, M17, M18	Defer to categorisation of the whole Transition Mire	Subsumed within TBMQ/2 and TBMQ/5	
4010	Northern Atlantic wet heath		H5, M14, M15, M16	Judge whether part of the mire or heath	88.53	Wet heath
4030	European dry heath		H1-4, H7-10, H12, H16, H18, H21		223.73	Dry heath

2015 Cranes Moor (and surrounding sites)

Of the Natura 2000 types, Code 7140 Transition Mire is well-represented, though as white beak sedge *Rhynchospora alba* is abundant this may also represent 7150 *Depressions in peat substrates with Rhynchospora.* 4010 North Atlantic Wet Heath and 4030 European Dry Heath are also well-represented. BAP Priority Habitats include Lowland Fen, Lowland Heathland, Lowland Dry Acid Grassland and a very small area of Wet Woodland.

Reference to the geological map shows that many discharges on the slopes of Stodgemoor Bottom and Broad Bottom are associated with the lower strata of the Chama Sand, a member of the Barton Series overlying the Barton Clay. Although not sufficiently base-enriched to produce NVC community M10 vegetation, it is less acidic than seepages from the overlying Becton Sand and gives rise to soakways of the M14 vegetation. There is potential for a substantial aquifer within the higher ground composed largely of the relatively porous Becton Sand, likely to discharge where meeting the water table of the valley floors or less permeable deposits such as lenses within the Chama Sand or with the Barton Clay. The products of seepage collect in the valley floors, most of which have tussocky purple moor-grass *Molinia caerulea* with reed that is rarely sufficiently dense to form reedbed.

Cranes Moor itself is a large plane area, sloping westwards with a vertical drop of about one metre over approximately 700m. Ridges including the Chama Sand, some barely elevated above the mire, protrude from the edge to give several embayments with sometimes contrasting vegetation. Water tracks and soakways have NVC M14 vegetation with black bog-rush *Schoenus nigricans*, but as this is often the only plant indicative of base-enrichment, its distribution does not define that of the M14, while much of the vegetation in which it occurs is NVC community M21a. The mire areas of Cranes Moor lie within a matrix of wet heath and there is an increasing proportion of NVC community M25a towards the outfall in the west. The floating fen and silt areas where the mud sedge *Carex limosa* has been found in previous surveys were not reached on this occasion.

Table 12: Areas of European Sites Qualifying SAC Features in Cranes Moor sites

Natura 2000		Subcategory (Report 5)	Indicative NVC	Caveats	Group C sites	
Code	Title				Area (ha)	NVC or type
7140	Transition Mire	Waterflow tracks TMQB/2	(M9), M14, M29		6.13	M14, M29
		Soligenous or rheotopogenous bog/oligotrophic base-poor mire	M21		25.47	M21a

Natura 2000		Subcategory (Report 5)	Indicative NVC	Caveats	Group C sites	
Code	Title				Area (ha)	NVC or type
		TMQB/5				
7150	Depressions in peat substrates with *Rhynchospora*		M21, M1, M2, M17, M18	Defer to categorisation of the whole Transition Mire	Subsumed within TBMQ/2 and TBMQ/5	
4010	Northern Atlantic wet heath		H5, M14, M15, M16	Judge whether part of mire or heath	63.89	Wet heath
4030	European dry heath		H1-4, H7-10, H12, H16, H18, H21		117.45	Dry heath

The nationally rare species of brown beak-sedge *Rhynchospora fusca* and marsh clubmoss *Lycopodium inundatum* were both recorded, the clubmoss being well distributed over parts of the site.

No alkaline fen was found in this study area.

2016 Holmsley, Whitten Bottom and Cardinal Hat Mires

Of the Natura 2000 types, Code 7140 Transition Mire is well-represented, though as white beak sedge *Rhynchospora alba* is abundant this may also represent 7150 Depressions in peat substrates with *Rhynchospora*. Two quadrats suggest that 7230 Alkaline Fen may be present, but only as a few small groundwater discharge points. Code 4010 North Atlantic Wet Heath and 4030 European Dry Heath also occupy large areas. BAP Priority Habitats include Lowland Fen, Lowland Heathland, Lowland Dry Acid Grassland and stands of Wet Woodland.

Table 13: Indicative areas for European Sites Qualifying SAC Features from NVC and other polygons

Natura 2000		Subcategory	Indicative NVC	Caveats	Group B sites	
Code	Title				Area (ha)	NVC or type
7230	Alkaline fen		M9, M10, M11, M13	Equivocal	Trace	M9a, M10a
7140	Transition Mire	Waterflow tracks TMQB/2	(M9), M14, M29		16.85	M6a, M14, M25a, M29
		Soligenous or rheotopogenous bog/oligotrophic base-poor mire TMQB/5	M21		21.28	M21a
7150	Depressions in peat substrates with *Rhynchospora*		M21, M1, M2, M17, M18	Defer to categorisation of the whole Transition Mire	Subsumed within TBMQ/2 and TBMQ/5	
4010	Northern Atlantic wet heath		H5, M14, M15, M16		75.37	Wet heath
4030	European dry heath		H1-4, H7-10, H12, H16, H18, H21		109.52	Dry heath

2016 Burley Lawn, Burley Rocks, Rock Hills and Clayhill Bottom

All four compartments of this study area have particularly fine examples of Natura Code 7140 Transition Mire, particularly in Burley Rocks. The transition is provided in a hydro-chemical rather than successional sense, as the NVC plant community sequence from M21a to M14 and M29 tracks a cline from acidic to more base-enriched conditions, to which the plants respond with a high diversity of species. The discharges from the Chama Sand is in places sufficiently base-enriched to support 7230 Alkaline Fen, though some important characteristic species of this type were not recorded. The site also has 6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils.

Table 14: Areas of European Sites Qualifying SAC Features in the Group A sites (around Burley)

Natura 2000		Subcategory (Report 5)	Indicative NVC	Caveats	Group A sites	
Code	Title				Area (ha)	NVC or type
7230	Alkaline fen		M9, M10, M11, M13	Equivocal	0.59	M10a
7140	Transition Mire	Water flow tracks TMBQ/2	(M9), M14, M29		14.17	M14, M29
		Soligenous or rheotopogenous bog/oligotrophic base-poor mire TMQB/5	M21		24.28	M21a
6410	*Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)		M24, M26		11.43	M24c
7150	Depressions in peat substrates with *Rhynchospora*		M21, M1, M2, M17, M18	Defer to categorisation of the whole Transition Mire	Subsumed within TBMQ/2 and TBMQ/5	
4010	North Atlantic wet heath		H5, M14, M15, M16	Judge whether part of mire or heath	41.75	Wet heath
4030	European dry heath		H1-4, H7-10, H12, H16, H18, H21		125.99	Dry heath

2017 Combined totals from all surveys carried out 2015-2017

Table 15: Indicative areas for European Sites Qualifying SAC Feature Categories from NVC and other Polygons

Natura 2000		Subcategory (Annex 5)	Indicative NVC	Caveats	All sites	
Code	Title				Area (ha)	NVC or type
7230	Alkaline fen		M9, M10, M11, M13	Equivocal	3.09	M9, M10a, M13a
7140	Transition Mire	Water flow tracks TMQB/2	(M9), M14, M29		56.48	M6a-d, M14, M29
		Water flow tracks TMQB/2	Speculative	Equivocal	558.12	M25a
		Soligenous or rheotopogenous bog/oligotrophic base-poor mire TMQB/5	M21		119.91	M2, M21a, M21b
7150	Depressions in peat substrates with *Rhynchospora*		M21, M1, M2, M17, M18	Defer to categorisation of the whole transition mire	subsumed within TBMQ/2 and TBMQ/5	
91DO	Bog Woodland	Valley mire variant	Tree cover over M21 mire	Must retain *Sphagnum* cover	No unequivocal examples (	
6410	*Molinia* meadows on calcareous, peaty or clayey-silt-laden soils		M24, M26		107.69	M24c
4010	Northern Atlantic wet heath		H5, M14, M15, M16	Judge whether part of mire or heath	155.13	Wet heath
4030	European dry heath		H1-4, H7-10, H12,	Excludes composite	1165.36	Dry heath

Natura 2000		Subcategory (Annex 5)	Indicative NVC	Caveats	All sites	
Code	Title				Area (ha)	NVC or type
			H16, H18 H21	polygons		

See Annex 5 for details of TMBQ categories. TMQB are the Transition Mire and Quaking Bog communities described by the JNCC. The suffixes are sub-types.

The mapped mire shown below is an example of the complexity of NVC communities existing in a large New Forest mire, mapped by Meade in 2017. It is the most thorough classification to date.

Figure C: Legend for vegetation and habitat map: NVC features

Legend for non-NVC features

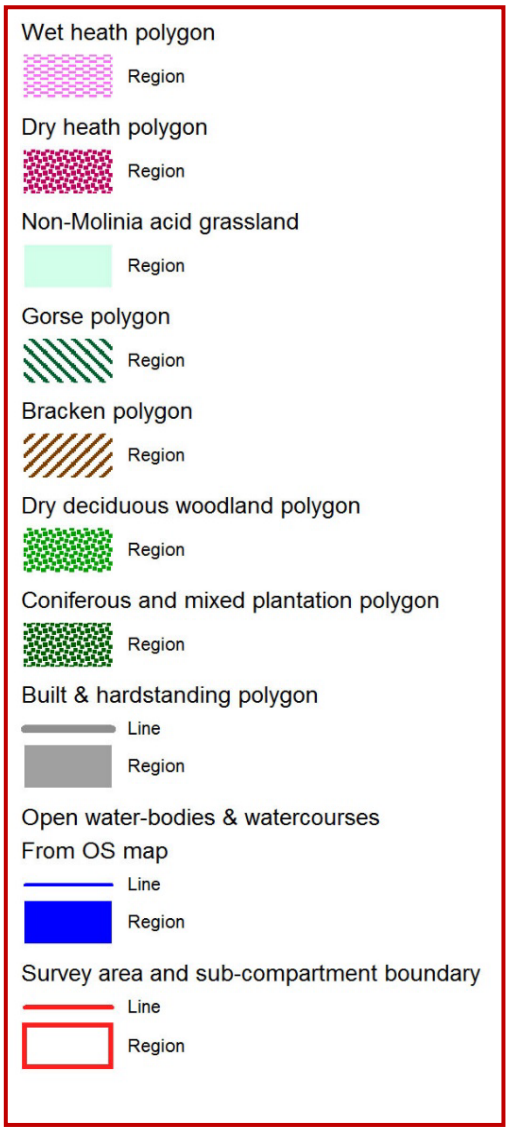
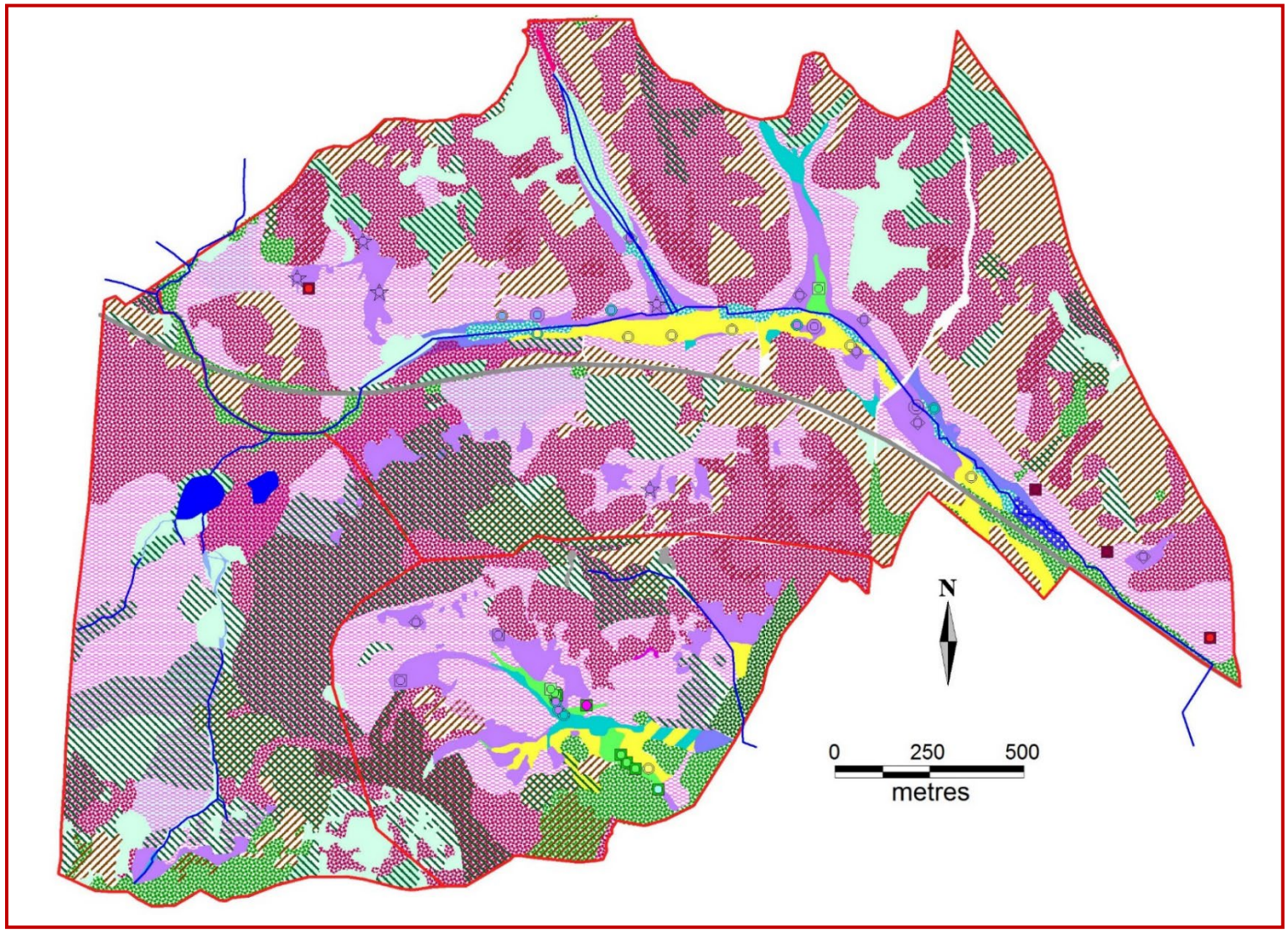


Figure D: Vegetation and habitat map for Holmsley, Whitten Bottom and Cardinal Hat Mires



There are some important points to consider from this detailed analysis:

- M25a and M21 communities make up the largest proportion of the mire systems surveyed, but they have no Corine equivalent.

- However, the *Rhyncosporion* does not exist in isolation, but rather as a transition between wet heath (M16) and mire (M21).

- This is also the case for Alkaline fen and Transition mire incorporating M9, M10, M11 and M13 in the former case and M14 and M29 in the latter.

- Grazing has a profound effect on mire communities particularly in relation to the ratio of M25 and M23 and hence M29 soakways.

Since such valley mires are the commonest bog systems in southern England and since they exist in transitions with the internationally recognised Rhynchosporion, Alkaline fen and Transition mire (depending on the pH of the underlying water), it would seem sensible as Meade (2017) advocates to slightly expand the classification of the TMQB communities to include all of the transitions embracing the typical New Forest valley mire communities.

New Forest dry grassland: description

The New Forest dry grasslands comprise a suite of communities which are described under the generic headings of *Parched acid grassland, Heathy acid grassland, Moist acid grassland, Neutral greens* and *Herb-rich bracken grassland*; a classification derived by Sanderson (1998). In terms of the National Vegetation Classification the first four are referable to U1, U3, U4 and MG6 respectively, while U20a is the nearest NVC equivalent to *Herb-rich bracken grassland*. There is no Qualifying Feature equivalent to New Forest dry grasslands.

Historically—and in the previous absence of a national classification—this suite of grasslands has been variously described as acid grassland greens, lawns, re-seeded grassland, partially improved grassland and neutral grassland. For clarity and to aid meaningful comparative evaluations, the dry grasslands are described under their generic headings by use of the NVC where possible. However, reference is made to historical definitions as they are still widely used.

Given a high and relatively uniform grazing pressure soil fertility and soil moisture retention are the main factors determining the distribution of the various dry grassland communities.

There are around 282ha of dry grassland communities in the New Forest. Its distribution is shown on map 7 at the end of this document.

Dry grassland plant community descriptions

Parched acid grasslands

Grasslands dominated by fine-leaved grasses especially *Agrostis capillaris*, *Festuca rubra* and *F. ovina* with a high cover of mosses and lichens, in an open sward which becomes parched and brown in late summer. Stands may be species-rich and the presence of *Rumex acetosella* and *Aira praecox* are especially diagnostic.

National Vegetation Classification

Parched acid grasslands are largely accommodated within U1.

U1: Sheep's fescue-Common bent-Sheep's sorrel grassland (*Festuca ovina-Agrostis capillaris-Rumex acetosella* Grassland)

Parched grassland on base-poor, nutrient-poor soils dominated by fine grasses especially *Agrostis capillaris*, *Festuca rubra* and *F. ovina*, with a high cover of mosses and lichens. Species characteristic of a sward which becomes parched in late summer are prominent, especially *Rumex acetosella*, *Aira praecox*, *Ornithopus perpusillus*, *Aphanes arvensis* and *Plantago coronopus*.

High grazing pressure and shortage of water (leading to non-availability of soil nutrients) leads to die-back of the vegetation in summer and the swards may take on a characteristic dry, brown appearance. The vegetation is open providing ample opportunity for the colonisation of diminutive annuals and other less competitive species, many of which are now nationally scarce and for which the New Forest is now a stronghold (see Table 16). These swards can be very species-rich and are of considerable nature conservation importance.

Sward heights are characteristically 1-2cm in the New Forest but a range of between 1cm to 5cm maximum would be acceptable. Visible bare ground is generally between 1% and 10% in an intimate mosaic with the vegetation. Species indicative of increased nutrient status, disturbance or significantly reduced grazing pressure and whose presence would trigger concern, include *Chamerion angustifolium*, *Cirsium arvense*, *C. vulgare*, *Plantago major*, *Urtica dioica* and coarse grasses such as *Holcus lanatus* and *Dactylis glomerata*. *Pteridium aquilinum* cover should not exceed 25% cover and should not be encroaching onto grassland communities.

Key species either dependent upon for all or part of their life cycle or using the New Forest dry grassland communities are tabulated below. In the New Forest, dry grassland is particularly rich in those species adapted to constant defoliation from hard grazing pressure. This in association with nutrient poor, acid soils produces open habitats with low competition from robust and aggressive species (e.g. coarse grasses). Hence the grasslands may be very species-rich and particularly in diminutive annuals. Invertebrate diversity is limited to those species requiring short vegetation and bare ground, though much structural diversity is provided by accompanying scrub where it exists in an intimate mosaic with the grassland.

Table 16: Vascular plants of dry grassland

Species/typical NVC communities	U1f	U1d/f	U1a	U3	U4	MG6	U20a
Moonwort (Botrychium lunaria)		X					X
Carline thistle (*Carlina vulgaris*)		X					
Field mouse-ear (*Cerastium arvense*)			X				
Chamomile (*Chamaemelum nobile*)*	X					X	
Mossy stonecrop (*Crassula tillaea*)*	X						
Small cudweed (*Filago minima*)	X	X	X				
Field gentian (*Gentianella campestris*)		X					
Smooth cat's-ear (*Hypochaeris glabra*)*			X				
Hairy bird's-foot trefoil (*Lotus subbiflorus)*	X						
Upright chickweed (*Moenchia erecta*)	X						
Burnet rose (*Rosa pimpinellifolia*)		X		X			X
Heath pearlwort (*Sagina subulata*)	X						
Field madder (*Sherardia arvensis*)		X					
Shepherd's cress (*Teesdalia nudicaulis*)			X				
Large thyme (*Thymus pulegioides*)		X					
Clustered clover (*Trifolium glomeratum*)*	X						
Bird's-foot clover (*T. ornithopodioides*)	X						
Rough clover (*T. scabrum*)	X						
Subterranean clover (*T. subterraneum*)	X						
Bearded fescue (*Vulpia ciliata ambigua*)*		X					
Wild gladiolus (*Gladiolus illyricus*)*							X
Soft-leaved sedge (*Carex montana*)				X			X
Lesser butterfly-orchid *(Platanthera*				X			X

Species/typical NVC communities	U1f	U1d/f	U1a	U3	U4	MG6	U20a
bifolia)							
Bitter vetch (*Lathyrus linifolius*)							X

* = Nationally scarce species

The New Forest U1 communities can largely be encompassed within the following NVC subcommunities:

U1f: Cat's-ear (*Hypochaeris radicata*) subcommunity

This is the typical subcommunity found in the New Forest, on soils with some impedance producing some winter waterlogging. It is characterised by the abundance of *Hypochaeris radicata*, *Leontodon saxatilis* and *Rumex acetosella* and is usually herb-rich. The bulk of the grass cover is comprised of *Festuca rubra* and *Agrostis capillaris*, though *Aira praecox* is frequent in the open sward. It occurs on undisturbed greens where lime enrichment has not occurred.

U1d/f: Sweet vernal-grass-Bird's-foot trefoil (*Anthoxanthum odoratum-Lotus corniculatus* subcommunity)

A combination of U1d and U1f confined to soils which have been disturbed in ways which have increased soil lime content. Classic examples include the sites of former wartime installations where the concrete hard standings or roads have been subsequently crushed and removed, or sites which were cropped in the 1940s and 1950s, or sites which were cultivated and limed in the 1960s and have all subsequently re-vegetated. An abundance of *Lotus corniculatus* is diagnostic, in an open sward with frequent *Festuca rubra*, *Agrostis capillaris* and *Rumex acetosella*, with patches of *Pilosella officinarum*. Where broken concrete is especially abundant as on former airfields then the community begins to take on the appearance of heavily grazed chalk grassland (CG7 *Festuca ovina-Pilosella officinarum-Thymus polytrichus/pulegioides* grassland). Calcicoles such as *Thymus* spp., *Cirsium acaule* and *Anthyllus vulneraria* are prominent.

H2/Ud: Species-rich dry heath

(Not described in NVC.) Where grazing is lighter than the U1d/f subcommunity tends to become invaded by *Calluna vulgaris* producing a species-rich dry heathland community. While basically similar to U1d/f some species become more frequent especially the violets *Viola canina* and *V. lacteal*; and the smaller, less competitive species decline in relation to the increasing *Calluna vulgaris* cover.

U1e: Heath bedstraw-tormentil (*Galium saxatile-Potentilla erecta*) subcommunity

A species-poor grassland with *Galium saxatile* and *Potentilla erecta* prominent. Typically occurs as stands on disturbed soils associated with dry heath and would be a derivative of dry heath by removal of heather if heavily sheep grazed.

U1b: Typical subcommunity

Stands lacking the characteristic species defining the other subcommunities. These include species-poor stands along paths but on freely draining sands in the west of the Forest some distinctive species-rich stands occur.

Qualifying Feature equivalent

There is no Qualifying Feature equivalent to the New Forest parched acid grasslands.

Historic description

Parched acid grasslands are not accommodated in the Westerhoff and Clarke (1992) report, nor were their distinctive character fully appreciated or described in Tubbs (1986). Hence, they have been variously referred to as acid grassland, greens, lawns, re-seeded grassland, partially improved grassland and neutral grassland. The original vegetation survey has been subsequently revised by Wright, Westerhoff and Sanderson to accommodate the parched acid grasslands.

Distribution of parched acid grassland

These swards form a major component in many settlement greens mainly as U1f typically in a mosaic with *Chamaemelum nobile* greens, e.g. Bolton's Bench, Lyndhurst. The lime-enriched U1d stands are dominant wherever cultivation has been carried out or broken wartime concrete survives in the soil—these are the main swards on the dried re-seeded areas. Otherwise parched acid grasslands tend to be found as small pockets on areas of dry, brown earths, sometimes on sites of obvious prior disturbance such as gravel pits, but often simply on patches of richer soil. Associated vegetation is typically heath but the community can even occur in larger pasture woodlands.

Extent of parched acid grassland

It is estimated that there are some 860ha of parched acid grassland in the New Forest.

Heathy acid grasslands

Dry grasslands dominated by *Agrostis curtisii* and *Molinia caerulea*, generally species-poor and grade into dry heath as heather cover increases.

National Vegetation Classification

The range of variation in the heathy acid grassland is accommodated within U3. There are no subcommunities of U3 described in the NVC.

U3: Bristle bent *(Agrostis curtisii)* grassland

Heathy acid grassland on dry to moist, base-poor soils, developed in response to prescribed burning and grazing. It is found on parched soils where soil fertility is too low for the development of parched acid grassland communities (U1). It is also found on soils which are too damp to support parched acid grassland communities, but which are too dry to carry wet grassland communities. The drier stands are dominated by *Agrostis curtisii* with varying quantities of *Aira praecox, Potentilla erecta, Rumex acetosella*, *Galium saxatile* and *Polygala serpyllifoilia*. The damper stands contain more *Molinia caerulea* with species such as *Pedicularis sylvatica* and *Carex panicea*. Locally there are more species-rich stands (more typical of the herb-rich bracken grassland), with *Succisa pratensis*, *Stachys officinalis*, *Serratula tinctoria* and *Carex montana*.

Agrostis curtisii is the dominant feature of this grassland and in places may form a virtually continuous cover—particularly when derived from recently burned dry heath stands. *Calluna vulgaris, Ulex minor* and *U. europaeus* are often components of the sward and on poorer soils. Where it has developed as a temporary phase in the regeneration of heath communities, a steady transition of increasing *Calluna vulgaris* and decreasing grassland species can be found.

Sward heights, percentage bare ground, negative indicator species and bracken cover are all as for parched acid grassland. This community is more prone to collection of dead plant material, particularly if bracken cover is significant. Generally plant litter should not contribute, in either discrete patches or wider blocks, to more than 25% of the sward.

Qualifying Feature equivalent

There is no Qualifying Feature equivalent of heathy acid grassland.

Historic description

Nearly all mapped as acid grassland in Westerhoff and Clarke (1992), based on Tubbs (1986). Subsequently revised by Wright, Westerhoff and Sanderson.

Distribution of heathy acid grassland

Dominates large areas of plateau and slope in the south of the Forest as at East End and

Boundway Hill, as well as forming smaller patches throughout the Forest. Associated with the occurrence of acidic (generally pH 4.5-5.5) brown earths poor in phosphate and potash and acutely deficient in lime, but also occurs on soils in various stages of podzolisation with highly impoverished upper horizons (Tubbs, 1986).

Extent of heathy acid grassland

It is estimated that there are some 1,258ha of heathy acid grassland in the New Forest.

Moist acid grassland

Species-poor grassland occurring locally as small strips between parched acid grassland and wet lawns, but also a distinctive community of damp pasture woodland glades. Characterised by fine leaved grasses especially *Agrostis capillaris* and *Festuca rubra* in association with *Galium saxatile*, *Potentilla erecta* and the moss *Rhytidiadelphus sqarrosus*. The species characteristic of the more species-rich parched acid grasslands are absent.

National Vegetation Classification

Moist acid grasslands are referable to U4, the ubiquitous grassland of the northwest uplands.

U4: Sheep's fescue-Common bent-Heath bedstraw grassland (*Festuca ovina-Agrostis capillaris-Galium saxatile* grassland)

In the New Forest these grasslands are rather species-poor, tightly grazed, grass dominated swards, on moist acid soils which are not as prone to desiccation as the parched acid grasslands. The only herbs of note are *Galium saxatile* and *Potentilla erecta*. *Molinia caerulea* is often present but at low cover. Sward heights, percentage bare ground, negative indicator species and bracken cover are all as for parched acid grassland. A feature of the Forest Moist Acid Grasslands where they occur as glades in the pasture woodlands, is the abundance of fungi, including some of the rarest species.

Qualifying Feature equivalent

There is no Qualifying Feature equivalent to moist acid grassland.

Historic description

Variously mapped as acid grassland or lawn depending on location, in the Westerhoff and Clarke survey (1992). Subsequently revised by Wright, Westerhoff and Sanderson.

Distribution of moist acid grassland

Substantial stands are restricted to glades within the pasture woodlands. Otherwise occurs as fairly indistinct transitions between parched acid grasslands and wet lawns.

Extent of moist acid grassland

It is estimated that there are some 54ha of moist acid grassland in the New Forest.

Neutral greens

Dry to moist grasslands characterised by a species-poor, grass dominated sward of *Agrostis capillaris* and *Festuca rubra*, but with *Cynosurus cristatus*, *Lolium perenne*, *Bellis perennis* and *Trifolium repens* as diagnostic species. Of note due to the presence of mats of *Chamaemelum nobile.*

National Vegetation Classification

Neutral greens are referable to MG6b subcommunity of the NVC.

MG6b: Perennial rye-grass-Crested dog's-tail-Sweet vernal-grass grassland (*Lolium perenne-Cynosurus cristatus-Anthoxanthum odoratum* subcommunity)

Species-poor grassland on moist soils usually produced by agricultural improvements such as fertilising, ploughing and re-seeding semi-natural swards. However, in the New Forest this grassland type is characteristic of village greens where centuries of stock dunging concentrated near to farmsteads and small holdings, has led to the development of enriched swards, in the absence of more modern treatments. While usually of low nature conservation interest many of the more ancient sites contain certain distinctive features not reflected in the NVC, the most prominent being the abundance of mats of *Chamaemelum nobile.*

Sward heights, percentage bare ground and negative indicator species, are all as for parched acid grassland.

Qualifying Feature equivalent

There is no Qualifying Feature equivalent to Neutral greens.

Historic description

A core community of the 'settlement lawns' of Tubbs (1986).

Distribution of neutral greens

Virtually confined to settlement edge greens on moist neutral soils near villages and farms.

Herb-rich bracken grassland

While *Pteridium aquilinum* can, to a greater or lesser extent, be a component of most of the dry grassland types described above (U1, U3 and U4), it forms a distinctive community on moist soils within a species-rich mosaic of grassland and woodland herbs. This herb-rich bracken grassland is characterised by the presence of grassland species such as *Succisa pratensis, Stachys officinalis*, *Serratula tinctoria, Platanthera bifolia*, *Carex caryophyllea* and *C. montana*, in a mosaic with woodland ground flora species, particularly *Hyacinthoides non-scripta*, *Anemone nemorosa* and *Viola riviniana*. This grassland forms the core habitat of *Gladiolus illyricus*.

National Vegetation Classification

All well grazed bracken stands are referable to the NVC community U20: Bracken-heath bedstraw community (*Pteridium aquilinum-Galium saxatile community*), becoming distinctive when bracken cover is between 25% cover and overwhelmingly dominant. All the grassy bracken swards (grassland communities referable to U1, U3 or U4) are best described as the sweet vernal-grass subcommunity (*Pteridium aquilinum-Galium saxatile* community, *Anthoxanthum odoratum* subcommunity). These have a variable cover of scattered bracken canopy but remain open allowing the grassland communities beneath to flourish under more sheltered conditions. The herb-rich bracken grassland is not definitively described in the NVC.

Qualifying Feature equivalent

There is no Habitats Directive equivalent to herb-rich bracken grassland.

Historic description

Not previously recognised as a distinctive community and mapped as acid grassland on Westerhoff and Clarke (1992). Subsequently revised by Wright, Westerhoff and Sanderson.

Distribution of herb-rich bracken grassland

Bracken stands are an integral part of virtually all heathland, grassland and pasture woodland stands in the New Forest, ranging from small patches to monospecific stands of tens of hectares. The latter are usually found in mosaics with parched acid grassland and heathy acid grassland and gorse.

The herb-rich bracken communities are more widespread in the south of the Forest, extending to an estimated 250ha.

New Forest wet grasslands: description

The New Forest wet grasslands (known colloquially as wet lawns) comprise a suite of plant communities confined to impermeable or slowly permeable clays, or permeable soils affected by high ground water levels, which are waterlogged in the winter but which dry out to some extent in the summer. They occur both on flushed soils on valley slopes and on floodplains of forest rivers and streams. They are generally tightly grazed swards characterised by the presence of *Agrostis canina* and sedges (especially *Carex panicea*, *C. nigra* and *C. viridula oedocarpa*, along with species typical of wet acid grasslands especially *Molinia caerulea*, *Succisa pratensis, Salix repens* and *Cirsium dissectum*. Extensive carpets of *Anagallis tenella* are seasonally prominent—and where soil water retention is highest, or around flushes, *Hydrocotyle vulgaris*, *Juncus acutiflorus* and *Hypericum elodes* are abundant. The more acidic sites support *Sphagnum* lawns and an increasing heathy element with *Erica tetralix*.

While highly distinctive the wet grasslands of the New Forest are not well defined in the NVC. Separation between the more enriched floodplain, rush pasture type (M23a), is more apparent than the separation between the more nutrient-poor flushed, fen meadow type which though generally referable to either M24c, M25b and M16b are in reality a complex mosaic which is very difficult to separate. They are profoundly affected by stocking regimes, soil moisture retention and soil fertility which are key factors in defining vegetation structure, community type and distribution (see Table 17 after Sanderson, 1999).

National Vegetation Classification

Classification within the NVC is not straightforward, as the high grazing pressure has produced a distinctive grassland variation which Sanderson (1999) has holistically described as *Agrostis canina-Carex panicea* grassland. However, they can generally be viewed as tightly grazed transitions of southwestern wet acid fen meadows comprising M23a, M24c, M25b and M16b.

M23a: Soft rush/Sharp-flowered rush-Marsh bedstraw-Sharp-flowered rush sub-community (*Juncus effusus/acutiflorus-Galium palustre-J. acutiflorus subcommunity*)

Wet lawns on the floodplains are generally referable to this community though in the Forest the rushes are tightly grazed giving the community little outward resemblance to typical

M23a rush pasture. Soils are more enriched and contain only limited amounts of *Molinia* but abundant *Carex nigra*. Associated species which occur frequently throughout the sward include *Achillea ptarmica, Galium palustre, Lotus pedunculatus, Mentha aquatica, Succisa pratensis, Valeriana dioica, Viola palustris* and *Cardamine pratensis*.

Sward heights are characteristically less than 2cm; and heights in excess of 40cm over more than 25% of the unit would indicate significant undergrazing. The rush domination seen in more typical fen meadow habitats in the southwest is not apparent in the tightly grazed swards in the Forest so over domination by *Juncus* species, defined by a cover of greater than 80%, is not likely to become a problem. Species indicative of increased nutrient status, disturbance or significantly reduced grazing pressure and whose presence would trigger concern include *Cirsium palustre* (when cover exceeds 20% of the unit), *Deschampsia cespitosa* (when cover exceeds 10% of the unit) and *Rumex crispus, R. obtusifolius, Urtica dioica, Cirsium arvense* and *C. vulgare,* all of whose presence should be no more than occasional. Visible bare ground is generally between one and 10% in an intimate mosaic with the vegetation, plant litter is generally scarce and should never exceed 25% cover. *Myrica gale* cover should not exceed 10% of the unit.

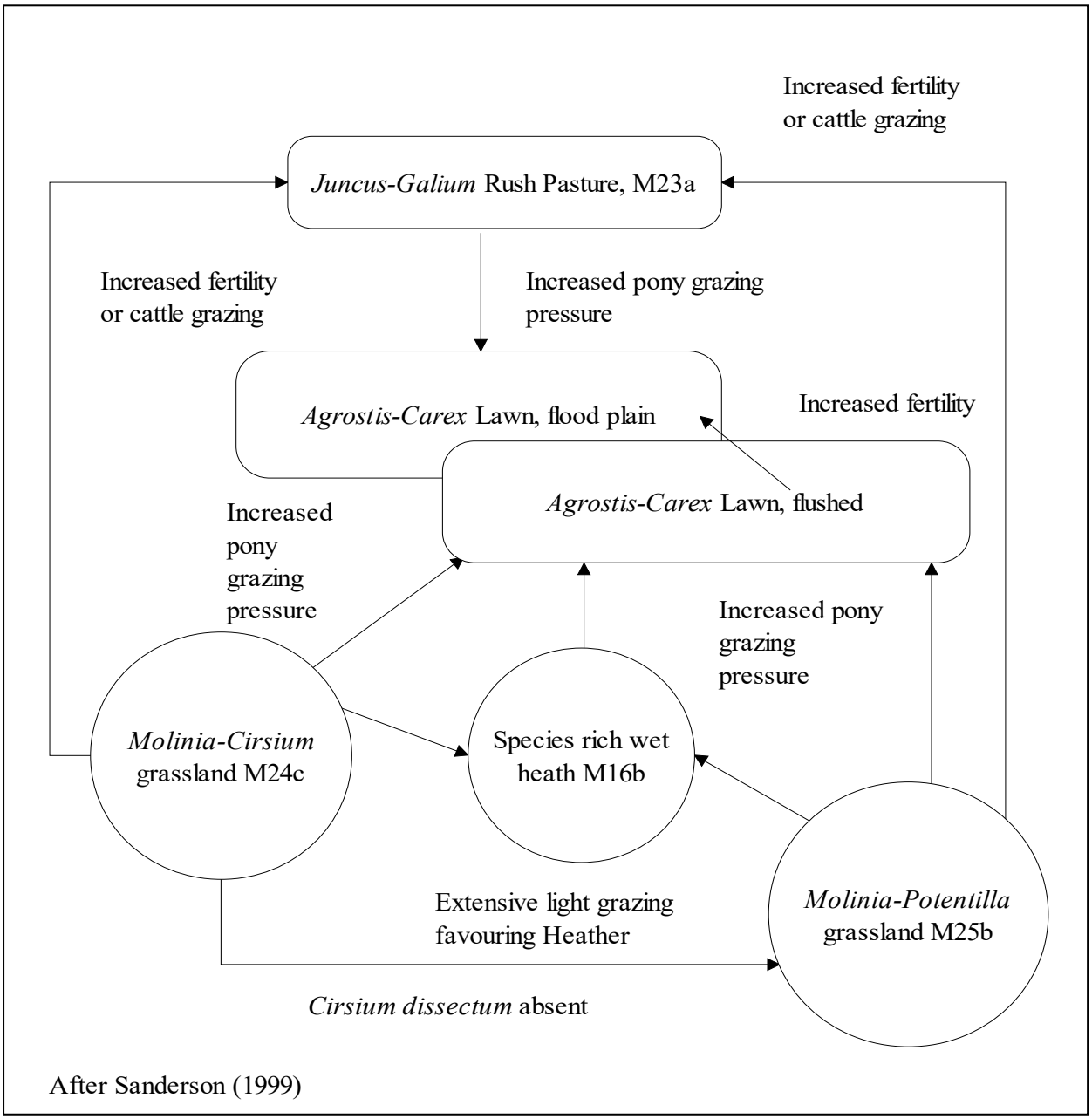
M24c *Molinia caerulea-Cirsium dissectum* Fen meadow-*Juncus acutiflorus-Erica tetralix* subcommunity

M25b *Molinia caerulea-Potentilla erecta* mire-*Anthoxanthum odoratum* subcommunity

M16b *Erica tetralix-Sphagnum compactum* wet heath *Succisa pratensis-Carex panicea* subcommunity

The flushed wet lawns of the valley slopes and pasture woodland glades are generally referable to these three communities. Community separation is very difficult. For M24c and M25b in the New Forest wet lawns, it is really no more than the presence in the former and absence in the latter of *Cirsium dissectum*. They are characterised by increased amounts of *Molinia* over the floodplain lawns and increased *Erica tetralix* and *Sphagnum* cover in the case of M16b. Typical associates include *Anagallis tenella, Galium palustre, Lotus pedunculatus, Narthecium ossifragum, Dactylorhiza maculata, Pedicularis sylvatica, Succisa pratensis, Serratula tinctoria, Valeriana dioica, Viola palustris, Carex hostiana, C. pulicaris, C. echinata* and *Genista anglica.*

Figure E: Relationships between wet acid grasslands in New Forest area



The general interrelationships of these communities in the New Forest are illustrated in Table 17 (Sanderson, 1999). Low grazing pressure favours the spread and dominance of *Molinia*, while heavy cattle grazing will tend to reduce *Molinia* but maintain *Juncus acutiflorus* dominance. Heavy grazing, especially by ponies will reduce the dominance of both *Molinia* and *Juncus acutiflorus* and increase *Agrostis canina* and *Carex* dominance. Extensive moderate grazing will give heather a competitive advantage.

Molinia will avoid the more fertile soils while *Cirsium dissectum* prefers slight lime enrichment but avoids the most base-rich calcareous soils where it is confined to tussocks. It is difficult to explain the distribution of *Cirsium dissectum* distribution on forest wet lawns, which within certain parameters, appears almost random; it typically forms dense patches in the sward and then can be absent for considerable stretches.

Sward heights are generally slightly taller than on the floodplain wet lawns and lie between 2-5cm. In exceptional cases sward heights may be greater but should not exceed 15cm for more than 25% of the unit. Other sward attributes are the same as for M23a.

Qualifying Feature equivalent

The wet grasslands of the New Forest comprise a complex and intimate mosaic of the various NVC plant communities described above. In the strictest sense the M24c *Molinia-Cirsium* fen meadows conform most closely to the Qualifying Feature: *Molinia meadows on calcareous, peaty or clayey-silt-laden soils*. However, since the only significant differentiator between M25b and M24c in the New Forest context is the presence or absence of *Cirsium dissectum*. The distribution of this species is not easy to explain, both M25b and M24c are considered to be referable to the *Molinia meadows on calcareous, peaty or clayey-silt-laden soils*.

Distribution of wet grassland

Large flood lawns dominate the non-wooded parts of the floodplains and flushed lawns are characteristic features of valley slopes and pasture woodland glades across the Forest. The distribution of wet grassland in the New Forest is shown on Map 8 at the end of this document.

Extent of wet grassland

It is estimated that there are some 1,063ha of wet grassland in the New Forest.

New Forest temporary ponds: description

The New Forest supports a range of distinctive vegetation communities restricted to water-filled shallow depressions on poorly drained soils which dry out temporarily during the summer months. Sanderson (1999) has derived a provisional classification of these temporary (or ephemeral) ponds which describes five distinct vegetation community types and has also attempted to refer each class to the National Vegetation Classification (NVC). These are:

1. 'Spike-rush-Purple moor-grass community' (*Eleocharis multicaulis-Molinia caerulea* community)

2. 'Lesser marshwort-Floating club-rush-Pillwort community' (*Apium inundatum-Eleogiton fluitans-Pilularia globulifera* community)

3. 'Creeping bent-Marsh foxtail-Knotweed community' (*Agrostis stolonifera-Alopecurus geniculatus-Persicaria* spp. community)

4. 'Floating sweet-grass community' (*Glyceria fluitans* community)

5. 'Pool edge assemblages'

In terms of the National Vegetation Classification the first four of these communities are broadly referable to M30, OV35, OV31/OV30 and S22; while there is not really an NVC equivalent for the pool edge assemblage (see below for details).

The temporary ponds support two Habitat Directive Annex I habitats:

1. Oligotrophic waters containing very few minerals of sandy plains: *Littorelletalia uniflorae*

2. Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoeto-Nanojuncetea*.

They also support an outstanding flora including many nationally scarce and rare species. Table 17 shows the relationship between the New Forest temporary ponds (after Sanderson, 1999), the NVC and the Habitats Directive. It also shows the interesting and nationally scarce/rare plant species associated with each community.

Table 17: The relationship between the New Forest temporary ponds (after Sanderson, 1999), the NVC, the Habitats Directive and the interesting and nationally scarce/rare plant species associated with each community

Temporary pond community (Sanderson, 1999)	NVC equivalent	Qualifying Feature equivalent	Associated species *= Nationally scarce **= Nationally rare
Eleocharis multicaulis-Molinia caerulea community	M30: *Hydrocotylo-Baldellion* of seasonally inundated habitats	Oligotrophic waters containing very few minerals of Atlantic sandy plains with amphibious vegetation	*Deschampsia setacea** *Littorella uniflora*
Apium inundatum-Eleogiton fluitans-Pilularia globulifera community	M30: *Hydrocotylo-Baldellion* of seasonally inundated habitats, but also referable to OV35 *Lythrum portula-Ranunculus flammula* Community Grades to M29 *Hypericum elodes-Potamogeton polygonifolius* soakway where there is water movement	Oligotrophic waters containing very few minerals of Atlantic sandy plains with amphibious vegetation	*Apium inundatum* *Baldellia ranunculoides* *Galium constrictum*** *Littorella uniflora* *Ludwigia palustris*** *Pilularia globulifera**
Agrostis stolonifera-Alopecurus geniculatus-Persicaria spp. community	OV31 *Rorippa palustris-Gnaphalium uliginosa* Community, but also referable to *Bidens tripartita-Persicaria hydropiper* Community.	Not included	*Limosella aquatica** *Ludwigia palustris*** *Mentha pulegium*** *Pulicaria vulgaris***
Glyceria fluitans community	S22 *Glyceria fluitans* water margin vegetation Community	Not included	*Galium constrictum***
Pool edge assemblages	No real equivalent described	Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoeto-Nanojuncetea*	*Carex viridula* *Cicendia filiformis** *Illecebrum verticillatum** *Radiola linoides*

Given a relatively high grazing pressure, the main factors in determining the distribution of the various temporary pond communities across the Forest are base status of the water (derived from the underlying soils); nutrient status and input; and the length of submergence.

Temporary pond community descriptions

Spike-rush-Purple moor-grass community (*Eleocharis multicaulis-Molinia caerulea* community)

Grazed swards of *Eleocharis* spp. and *Molinia caerulea,* often with carpets of *Sphagnum,* particularly *Sphagnum cuspidatum* and *S. auriculatum*. Typically found in pans and runnels in wet heath where acid, nutrient-poor water collects, but which is not sufficiently permanent for bog pool communities to develop.

Apparently referable to the unsampled communities covered (but not described) in the NVC as M30: *Hydrocotylo-baldellion of seasonally inundated habitats* in which it refers to stands of vegetation in which *Eleocharis multicaulis* is strongly dominant in the absence of more acidic bog pool species (e.g. *Potamogeton polygonifolious*). A characteristic associate is the presence of *Deschampsia setacea*, a nationally scarce species restricted to this community in the New Forest, together with *Littorella uniflora.*

Qualifying Feature equivalent

Oligotrophic waters containing very few minerals of sandy plains: *Littorelletalia uniflorae*.

Lesser marshwort-Floating club-rush-Pillwort community (*Apium inundatum-Eleogiton fluitans-Pilularia globulifera* community)

Mixed vegetation characterised by the presence of *Apium inundatum*, *Eleogiton fluitans* and the nationally rare, grass-like fern *Pilularia globulifera*, together with frequent *Glyceria fluitans*, *Lythrum portula*, *Juncus bulbosus*, *Baldellia ranunculoides* and *Eleocharis multicaulis*. Typical associates of the well-grazed Forest temporary pond communities include the two nationally rare species *Galium constrictum* and *Ludwigia palustris*, together with *Littorella uniflora*. Found in temporary ponds with less acidic but nutrient-poor water, typically found in depressions within wet grassland vegetation.

In terms of the NVC this community is referable to M30 (above) but also to OV35: *Lythrum portula-Ranunculus flammula* community. Where there is water movement (e.g. in linear features) then this community grades into a less acidic version of M29: *Hypericum elodes-Potamogeton polygonifolious soakway*).

Qualifying Feature equivalent

Oligotrophic waters containing very few minerals of sandy plains: *Littorelletalia uniflorae*.

Creeping bent-Marsh foxtail-Knotweed community (*Agrostis stolonifera-Alopecurus geniculatus-Persicaria* spp. community)

A variable community ranging from grassy to herb dominated communities with the grasses *Agrostis stolonifera*, *Alopecurus geniculatus* and occasionally *Glyceria* spp., with the ruderal herbs *Gnaphalium uliginosum*, *Persicaria hydropiper, P. minor*, *P. maculosa*, *Bidens tripartita* and *Potentilla anserina*. These temporary ponds are notable for the presence of the nationally scarce *Limosella aquatica* and the three nationally rare species, *Mentha pulegium, Ludwigia palustris* and *Pulicaria vulgaris*.

These communities are associated with higher nutrient status and fairly neutral pH, in situations where heavy grazing results in poaching and the accumulation of dung. Typically found within neutral greens (MG6b) and in water-retaining depressions in parched acid grasslands (U1).

These nutrient enriched communities are most closely referable to NVC community OV31*: Rorippa palustris-Gnaphalium uliginosa* community. However, there are considerable differences—and there are also strong similarities to OV30: *Bidens tripartita-Persicaria hydropiper* community.

Qualifying Feature equivalent

There is no Qualifying Feature equivalent to this community.

Floating sweet-grass community (*Glyceria fluitans* community)

These are stands dominated by *Glyceria fluitans* in flood channels in floodplain wet grasslands. While grazing reduces the dominance of *Glyceria* they are relatively species-poor stands compared to the other community types, though notable on occasion for the presence of the nationally rare *Galium constrictum.*

This community is directly referable to the NVC community S22: *Glyceria fluitans Water Margin Vegetation.*

Pool edge assemblages

These are communities on the edge of large temporary ponds, shallow ephemeral pools and poached damp hollows in grassland which support a number of specialist species in a zone with *Juncus bufonius*. These include the two nationally scarce species *Illecebrum verticillatum* and *Cicendia filiformis*, often in association with *Radiola linoides* and *Anagallis*

minima.

There is no NVC equivalent to such plant assemblages.

Qualifying Feature equivalent

Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and *Nanojuncetea*.

For all temporary pond communities:

Heavy grazing pressure is of prime importance in the maintenance of the outstanding flora of these temporary pond communities in the New Forest. It maintains an open habitat, controlling scrub ingress and stock trample the surface. Commoners' animals also transport seed in their hooves from pond to pond widely across areas where suitable habitat exists. Accordingly, all temporary ponds should be grazed and at the end of the summer, when they will generally be surface dry, between 25% and 75% of the ground should be bare and trampled to some degree. Water chemistry and sediment quality should be maintained and aggressive species dependent upon very high nutrient level such as *Juncus bulbosus var. fluitans* should not exceed 50% cover and algal species should not become dominant for long periods. Invasive non-native species, particularly *Crassula helmsii* and *Myriophyllum aquaticum* should be absent.

Distribution

Temporary ponds occur throughout the Forest in depressions capable of holding water for part of the year. The nutrient-rich *Agrostis-Alopecurus-Persicaria* community are confined to settlement edge greens, the *Glyceria fluitans* community mainly to floodplain wet grassland, pools with *Eleocharis-Molinia* community in undrained heathland basins and the *Apium-Eleogiton-Pilularia* community and pool edge assemblages to wet grassland and acid grassland further from settlements.

Extent of temporary ponds

Since most temporary ponds are relatively small (between 5-10m across) they are yet to be surveyed and mapped in detail on the SAC vegetation map. However, it is likely that the *Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and the Nanojuncetea* communities amount to less than 10ha in total area though great in number.

The oligotrophic waters containing very few minerals of sandy plains: Littorelletalia uniflorae communities are widespread in wet heath, but each site is small (usually 2-5m wide) and so

are unlikely to exceed 1ha in total extent.

New Forest permanent ponds and streams: description

Since 2001 there have been notable surveys carried out under contract to Forestry England and Natural England on some of the 1,000-or-so ponds in the New Forest (Ewald, 2014; Footprint Ecology, 2018). These surveys have looked at various issues affecting the condition of a variety of permanent and temporary ponds and some ditches and have demonstrated that while *Crassula helmsii* invasion affecting 18% of 700 waterbodies surveyed (Ewald, 2014) and nutrient enrichment are areas of concern, pony grazing is advantageous in managing both issues (see Part 3 for details).

Ewald et al (2014) conducted a random stratified survey of 38 ponds identifying wetland plants and beetles to species level, while listing a variety of other invertebrates, including medicinal leech and fairy shrimp. They listed 21 plant species and 13 beetle species of conservation concern.

Hatchet Pond has been subject to detailed survey—and a restorative Management Plan has been prepared (Footprint Ecology, 2018). Two additional issues, which, while not unique to Hatchet Pond, are significant in affecting its nature conservation interest, have been examined and restorative measures proposed. These centre on the effects of imported non-endemic fish species for fishing interests, as well as the management of a recreational focus point.

While the surveys did not attempt to build on the classification of ponds in the original SAC Plan, they nonetheless all supported the outstanding importance for nature conservation of these temporary and permanent waterbodies.

The following description of the vegetation of New Forest permanent ponds and streams should be regarded as provisional in the absence of detailed survey/quadrat data.

Ponds and slow-moving streams: strongly acid waters

Strongly acid ponds are local within wet heathland on the southern terraces but rare elsewhere. They can be defined by the abundance of *Juncus bulbosus* and presence of *Sphagnum*, especially *Sphagnum denticulatum* (*auriculatum*) or *Sphagnum cuspidatum* in very peaty water. Acid stream heads occur close to the valley bogs that can also be dominated by *Juncus bulbosus* but such dystrophic (very acid peat stained) conditions do not extend far down the streams and are replaced in the valley bogs by *Hypericum-Potamogeton Soakways* (M29).

Most stands are referable to the NVC community *Juncus bulbosus* community*, Sphagnum denticulatum* subcommunity (A24b)

The community is usually dominated by *Juncus bulbosus* and *Sphagnum* mats. It can consist of little else but species such as *Eleogiton fluitans* and *Potamogeton polygonifolius*. *Hypericum elodes* can be present. The community is floristically close to M29 soakway and tends to be replaced by this where water movement is strong as *Hypericum elodes* increases in abundance.

Qualifying Feature equivalent

This NVC community is referred to the *Utricularietalia* order by Rodwell (2000). This implies that these acidic and peaty (dystrophic) ponds are referable to the Qualifying Feature habitat *22.14: Natural Dystrophic lakes and ponds*. These dystrophic ponds have a very southwestern stamp compared with upland dystrophic ponds (Newbold; personal communication) and may well be of SAC quality but would require further work to establish their appropriate classification in the European sense. Currently, this is not a Qualifying Feature of the New Forest SAC.

Faster flowing streams

Faster flowing and somewhat less acidic water of streams can be dominated by *Myriophyllum alterniflorum*. Referable to the NVC Community *Myriophyllum alterniflorum* (A14), generally species-poor stands dominated by *Myriophyllum alterniflorum*.

Qualifying Feature equivalent

A generally upland community referred to the *Ranunculion fluitantis* alliance by Rodwell (2000). This implies that these streams may be referable to the Qualifying Feature habitat *24.4: Floating vegetation of Ranunculus of plain submountainous rivers* but further work would be required to establish their appropriate classification in the European sense. Currently, this is not a Qualifying Feature of the New Forest SAC.

Acid/neutral water: streams

The majority of the deeper steams of the New Forest support mixtures of *Ranunculus peltatus* and *Callitriche* spp., certainly including *Callitriche obtusangula* but probably other *Callitriche* species as well. Associated species include *Myriophyllum alterniflorum*, *Elodea canadensis*, *Potamogeton polygonifolius*, *Potamogeton natans* and *Sparganium emersum*. In well-lit streams with shallow margins, short mixed marginal vegetation is prominent;

usually dominated by mixtures of *Apium nodiflorum*, *Glyceria* species and *Potamogeton polygonifolius*, with many other associated species. Species such as *Apium nodiflorum* can reach into the deeper water in the centre of the streams. Tufts of *Sparganium erectum* can form small stands of swamp in less accessible edges. These well vegetated streams are most typical of rivers in the south of the Forest.

Woodland permanent streams are widespread and generally have a sparser cover of *Ranunculus peltatus* and *Callitriche* spp., but a distinctive bank flora with a high cover of bryophytes, ferns, especially *Athyrium filix-femina* and woodland herbs and grasses. Better lit pools in the lower reaches of the wood streams have stands of yellow water lily *Nuphar lutea* associated with a few populations of the northern *Potamogeton alpinus* on the Beaulieu and Lymington Rivers.

Many smaller streams run in winter only and tend to have bottoms consisting largely of bare gravel, especially in the north of the Forest. A specialised habitat is found in the smaller gravely woodland streams. As long as the flint gravels are not moved around too much, they support a small but distinctive lichen flora on the flint pebbles. This may include two apparently undescribed species and it is not simply an impoverished upland stream flora (Glibert and Giavarini, 1997). The lichens are absent from heathland streams and appear to be a particular feature of small streams within old growth woodland.

Qualifying Feature equivalent

The main NVC communities of the streams are the *Ranunculus peltatus* community (A20) and *Callitriche stagnalis* community *Callitriche* subcommunity (A16a). Both are referred to the *Callitricho-Batrachion* alliance by Rodwell (2000). This implies that these streams may be referable to the Qualifying Feature habitat 24.4: *Floating vegetation of Ranunculus of plain submountainous rivers* but further work would be required to establish their appropriate classification in the European sense. Currently, this is not a Qualifying Feature of the New Forest SAC.

Nutrient-poor acid/neutral ponds

These are exemplified by Hatchet Pond and support aquatic vegetation equivalent to the *Pilularia-Apium inundatum* ephemeral ponds. These species are absent but the pond base is dominated by *Littorella uniflora*, a species that is more scattered in ephemeral ponds. A distinctive associated aquatic species is the nationally scarce *Elatine hexandra*. The pond margins have a distinctive amphibious community of *Eleocharis acicularis* that is lacking from the ephemeral ponds and appears to depend on a fairly constant water level.

In Hatchet Pond there are also distinctive swamp communities of emergent species in the

more base-enriched area near the flooded marl pits. This is dominated by *Menyanthes trifoliata* and the nationally rare *Ludwigia palustris* along with *Equisetum fluviatile*.

The distribution of permanent ponds with this sort of vegetation beyond Hatchet Pond is not clear and should probably be investigated. Sowley Pond has records of *Littorella uniflora* and *Elatine hexandra* some may have, or had similar vegetation (Brewis et al, 1996). It does also have an area of *Ludwigia palustris* swamp.

The aquatic and amphibious communities of permanent ponds are clearly referable to the *Littorelletalia*, an order not sampled by the NVC in the lowlands. The *Littorella uniflora* dominated aquatic community is clearly referable to the *Litterellion uniflorae* alliance and closest to the upland NVC community *Littorella uniflora-Lobelia dortmanna* community *Littorella uniflora* subcommunity (A22a) but lacking the *Lobelia dortmanna*. The *Eleocharis acicularis* amphibious community belongs to the *Eleocharition acicularis* alliance that was not sampled by the NVC.

The *Menyanthes trifoliata-Ludwigia palustris* swamp is a southern version of the NVC community *Equisetum fluviatile Swamp-Carex rostrata* subcommunity (S10b). This is a mainly upland community, which interestingly is a locus of several rare upland species such as *Lysimachia thyrsiflora*. Sanderson has seen *Eriophorum gracile* in another lowland version of S10b in Surrey.

Qualifying Feature equivalent

These *Littorelletalia* are referable to the Qualifying Feature habitat: Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*).

Richer acid/neutral ponds

More typical of the permanent ponds are communities of somewhat more nutrient-rich situations lacking *Littorelletalia* species. For the most part these are small and fairly shallow with *Ranunculus peltatus* prominent with varied associates including *Glyceria fluitans*, *Glyceria declinata*, *Alisma plantago-aquatica*, *Potamogeton natans* and *Callitriche* species. Associated emergents include *Eleocharis palustre* in grazed areas and *Typha latifolia* and *Sparganium erectum* in deeper water.

Many of the deeper ephemeral *Pilularia-Apium inundatum* ponds will have *Ranunculus peltatus* prominent in the spring aquatic phase but this will be mixed with *Littorelletalia* species. The characteristic hybrid crowfoot *Ranunculus x novae-forestae*, which is apparently endemic to the New Forest and confined to the aquatic phase of ephemeral ponds (Brewis et al, 1996).

Locally in the south of the Forest somewhat more nutrient-rich shallow ponds *Ranunculus aquatilis* can replace *Ranunculus peltatus*. Associated species include *Glyceria fluitans* and *Apium nodiflorum*.

The vegetation of deeper permanent ponds of the New Forest requires further investigation *Potamogeton natans* communities certainly occur.

The widespread community of shallower ponds is referable to NVC community *Ranunculus peltatus* community A20 with associated *Typha latifolia* Swamp (S12) and *Sparganium erectum* Swamp (S14). The A20 communities is referred to the *Callitricho-Batrachion* alliance by Rodwell (2000).

The other NVC aquatic communities present are *Ranunculus aquatilis* community A19 and *Potamogeton natans* Communities A9. Both of these are referred to the *Nympheaion* alliance.

Qualifying Feature equivalent

None.

New Forest mammals

No mammal species are Qualifying Features of the New Forest SAC but the New Forest heathland and woodland SAC habitats support a range of mammals, including 18 species of conservation concern (see Table 18).

While there are no deer census figures for the whole of the SAC, Forestry England (2019) has provided estimates of deer numbers across the Crown Lands.

The New Forest now has five established species. On the Crown Lands fallow are present in high numbers and widespread. Red and sika are localised and present in fairly low numbers and with roe increasing across the Forest as habitat improves following reduction in the fallow population. Muntjac is present in the Forest despite efforts to prevent their colonisation. Muntjac is a species now widespread in southern and central England which has taken advantage of the Forest's areas of increased bracken, bramble, holly, rhododendron cover as well as restock sites. Fallow, in view of their higher population numbers and widespread distribution, have the largest potential impact on pasture woodlands—their preferential grazing habit and ability to feed over wide areas including the Inclosures and adjoining farmland, means that they are less dependent upon the Open Forest than domestic stock. Overall however, fallow can have a relatively high impact on

the Inclosure woodland understorey and a significant impact on tree regeneration both inside and outside of the Inclosures. They also heavily influence the subsequent composition of tree species within affected woods.

Grey squirrels, imported from eastern North America, were introduced to the New Forest, as elsewhere in Britain, in the early 20th century. They are now widespread and common and subject to largely ineffective control. Native red squirrel is extinct in the New Forest and will remain so while grey squirrels are present.

Fox, hedgehog and badger are widespread though relatively uncommon where food supply is low. Rabbit populations are localised, on the Forest dry grasslands/dry heath mosaics, where they contribute considerably to the botanical diversity of the sward and provide opportunities for other species dependent upon bare sandy ground for part of their life cycle (e.g. sand lizard and a whole host of invertebrate species). Rabbits are now found in much lower numbers that in previous decades. Stoats and weasels are present in very low numbers, their distribution related to that of their principal prey species (rabbits and small mammals). Brown hare *Lepus capensis* are rare within the SAC, principally found in the southeast where the Forest adjoins neighbouring farmland.

Where vegetation structural diversity is low as a result of livestock grazing, small mammal numbers are also low in comparison to ungrazed habitats (Tubbs, 1986), due to an absence of suitable habitat (especially with regard to shelter and food). However, wood mice *Apodemus sylvaticus* and field vole *Microtus agrestis* are recorded at very low densities on the grazed open heathland. Broadleaved woodlands support yellow-necked mice *Apodemus flavicollis*, bank vole *Clethrionomys glareolus*, common and pygmy shrews *Sorex araneus* and *S. minutus*—and where soils are rich enough to support earthworms, mole *Talpa europeaus.* The Inclosures on the Crown Lands which are to remain enclosed have the capacity to support significantly higher populations of small mammals.

Otter are present across the New Forest in low numbers. Mink are also present, a result of release from mink farms back in 1980s. Water vole are present in very low abundance this is due to a lack of suitable habitat within the New Forest as well as the presence of mink.

Table 18: Mammal species of conservation concern present in the New Forest

Species	Habitat	Distribution	Status
Water vole *Arvicola terrestris*	Streams and rivers	Rare	Schedule 5 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Endangered)
Otter *Lutra lutra*	Streams and rivers	Low numbers	Annex II and IV Habitats Directive Schedule 5 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Least Concern)
Polecat *Mustela putorius*	Forest and farmland	Rare	Schedule 6 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Least Concern)
Pine marten *Martes*	Woodland	Rare	Schedule 5 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Critically Endangered)
Dormouse *Muscardinus avellanarius*	Woodland	Rare, Lymington River woodland corridor, Langley Wood	Annex IV Habitats Directive Schedule 5 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Vulnerable)
Barbastelle bat *Barbastella barbastellus*	Wood pasture	Rare	Annex IV Habitats Directive Schedule 5 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Vulnerable)
Common pipistrelle bat *Pipistrellus pipistrellus*	Trees or buildings	Common	Annex IV Habitats Directive Schedule 5 Wildlife and Countryside Act

Species	Habitat	Distribution	Status
			Section 41 NERC Act British Mammal Red Data Book (Least Concern)
Soprano pipistrelle bat *Pipistrellus pymaeus*	Trees or buildings	Common	Annex IV Habitats Directive Schedule 5 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Least Concern)
Grey long-eared bat *Plecotus austriacus*	Trees or buildings	Rare	Annex IV Habitats Directive Schedule 5 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Endangered)
Brown long-eared bat *P. auratus*	Trees or buildings	Rare	Annex IV Habitats Directive Schedule 5 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Least Concern)
Serotine *Eptesicus serotinus*	Trees or buildings	Rare	Annex IV Habitats Directive Schedule 5 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Vulnerable)
Noctule *Nyctalus noctula*	Wood pasture	Rare	Annex IV Habitats Directive Schedule 5 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Least Concern)
Leisler's bat *N. leisleri*	Wood pasture	Rare	Annex IV Habitats Directive Schedule 5 Wildlife and Countryside Act British Mammal Red Data Book (Near Threatened)
Bechstein's bat	Wood pasture	Rare	Annex II and IV Habitats Directive

Species	Habitat	Distribution	Status
Myotis bechsteinii			Schedule 5 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Least Concern)
Daubenton's bat *M. daubentonii*	Wood pasture	Rare	Annex IV Habitats Directive Schedule 5 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Least Concern)
Brandt's bat *M. brandtii*	Wood pasture	Rare	Annex IV Habitats Directive Schedule 5 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Data Deficient)
Whiskered bat *M. mystacinus*	Wood pasture	Rare	Annex IV Habitats Directive Schedule 5 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Data Deficient)
Natterer's bat *M. nattereri*	Wood pasture	Rare	Annex IV Habitats Directive Schedule 5 Wildlife and Countryside Act Section 41 NERC Act British Mammal Red Data Book (Least Concern)

Mammal species of conservation concern

The broadleaved woodlands are a main focus for mammal species of conservation concern. Principal among those are the bats, particularly Bechstein's and Barbastelle, species dependent upon old trees with holes and an abundant flying insect fauna associated with the New Forest habitat mosaic of heathland and woodland. Other bat species established in the Forest include pipistrelle, grey long-eared, serotine, noctule, brown long-eared, natterer's, Daubenton's, whiskered and Brandt's.

Dormouse (*Muscardinus avellanarius*)

A species requiring dense shrub layers is not present in pasture woodlands or plantations in the Forest but has been recorded from the Lymington River woodland corridor and Langley Wood.

The Forest streams and rivers (particularly the Lymington River and tributaries of the Hampshire Avon) support otter. Water vole is now very restricted in its distribution due to the presence of American mink.

In recent years there have been a number of unverified New Forest records of polecat, a species that is expanding its range in southern England. This species is likely to be present in low numbers, limited by the availability of suitable prey available in the Forest.

There have been several records of pine marten from the centre of the Forest. It is thought that these individuals have been introduced and it is uncertain whether the Forest supports a viable population.

Mammals and the law

Many of the mammal species present in the New Forest are afforded various levels of legal protection under national and international legislation. Most notably, those European Protected Species including all species of bat, otter and dormouse.

Exceptions

An important defence to any prosecution that might be brought is the exception that where the killing, injuring or taking, disturbance and destruction of breeding, resting and sheltering places, has occurred inadvertently as an incidental result of a lawful operation by an authorised person (i.e. the owner or occupier or any person authorised by the owner or occupier), no offence has been committed. All recognised forest and heathland management operations are lawful and although these can be carried out at times of year

when these species are vulnerable, the spirit of the Act is clear: **the needless and deliberate destruction of protected species is unacceptable, and the onus is on the owner to carry out operations in a reasonably sensitive way.** Generic advice on good practice woodland management in the presence of European Protected Species (bats, otter and dormouse) can be found at https://www.gov.uk/guidance/manage-and-protect-woodland-wildlife.

New Forest birds

The New Forest supports an exceptionally rich bird fauna including internationally important breeding populations and wintering populations of bird species associated with SAC habitats which are Qualifying Features of the New Forest SPA:

Pernis apivorus; European honey-buzzard (breeding)
Circus cyaneus; Hen harrier (non-breeding)
Falco subbuteo; Eurasian hobby (breeding)
Caprimulgus europaeus; European nightjar (breeding)
Lullula arborea; Woodlark (breeding)
Sylvia undata; Dartford warbler (breeding)
Phylloscopus sibilatrix; Wood warbler (breeding)

The New Forest SAC also supports a variety of other bird species exploiting heathland or woodland habitats preferentially or in some cases both where feeding and nesting or roosting habitat preferences differ.

Heathland birds

While the heathland habitats are of international importance for certain breeding and wintering bird species, there is a relative paucity of birds (species and numbers) on heathland. This is related to the fact that the British avifauna is largely of woodland origin coupled with the relatively uniform structure of heathland habitats and inadequate year-round food supply. For example, there are no large wintering flocks of finches, starlings or other passerines on open heathland due to the shortage of insects and seed. Those species that do overwinter on heathland (e.g. wren, stonechat, meadow pipit and Dartford warbler) are highly dependent upon *Ulex europaeus* which provides a rich though variable, invertebrate food supply all year round; and when in suitable condition, cover, shelter and in the breeding season, nest sites. Over the past 20 years a number of declines have been observed. Skylark remain common and wheatear occasional, although the latter is no longer thought to breed in the Forest. Other passerines include linnet, chiffchaff, dunnock, robin, blackbird and green woodpecker. There are now only a few breeding pairs of

yellowhammer and whitethroat. In the last 20 years species such as grasshopper warbler and willow warbler have been lost from the Forest. The above assemblage of passerines tends to be more reliant on woodland edge/scrub habitats, than directly upon heathland. Indeed the structural mosaic of heathland habitats, with birch scrub and bracken components are of much greater value to most birds than uniform tracts of heather.

Heathland and heathland/woodland edge specialists include Dartford warbler, woodlark and nightjar—these are covered in more detail below. Other avian species favouring this habitat are tree pipit and red-backed shrike. The former remains widespread but in much lower numbers than 20 years ago. The latter was last recorded breeding in the Forest in 1978; its decline possibly being related to climatic deterioration. Another species dependent upon heather but extinct in the New Forest since the 1930s is black grouse.

Among the raptors, hen harrier and merlin overwinter on the Forest heathland, roosting in dense heather though feeding over a much greater range of habitats including adjacent farmland. Hobby are a notable summer visitor to the heathlands, breeding in good numbers (up to 25 pairs) using old crows nests mainly in woodland edge habitats and feeding over open habitats on swallows and martins and larger flying insects, particularly *Odonata*. The national status of hobby has changed significantly in recent years with them spreading north into farmland and now breeding in southern Scotland. While this change has taken place the number of pairs breeding in the Forest has declined in the past decade. Four pairs were known to breed in 2020. The reasons for the decline here have been attributed to the increase in breeding goshawks and although predation by goshawk has been witnessed this is probably only a contributing factor. The decline in house martins locally, which was an important food resource when feeding their young may be more significant as well as a possible decline in invertebrates such as moths. Historically Montagu's harrier attempted breeding in the Forest in most summers, but unfortunately, they were repeatedly unsuccessful and no longer breed here. Red kite are occasionally seen in the Forest, individuals from a well-established reintroduction programme in Oxfordshire which continue to expend into neighbouring counties. More recently white-tailed eagles have been reintroduced to the Solent area and individuals are occasionally seen over the Forest.

The wetland heathland habitats (mires, pools and wet grassland) provide a valuable locus for inshore breeding waders including redshank, snipe, curlew and lapwing; breeding mallard and teal; and occasionally shelduck. The larger Forest rivers and streams are important for kingfisher and grey wagtail.

Those birds of recognised conservation concern are listed against their preferred habitats with an indication of status, where known, in Table 19. Of particular significance are the species for which the Forest is designated as a Special Protection Area (breeding Dartford warbler, nightjar and woodlark and overwintering hen harrier) and these are dealt with in greater depth on an individual basis below.

Table 19: Bird species of conservation concern regularly occurring in the New Forest

Species	Habitat	Distribution	Protection/status
Shelduck *Tadorna tadorna*	Valley mires/Permanent ponds	Very occasional breeder (few pairs), common	RSPB Amber List
Teal *Anas crecca*	Valley Mires/Permanent ponds	Irregular breeder, infrequent	RSPB Amber List
Montagu's harrier *Circus pygarus*	Dry heath (breeding)	Very rare, not bred since 1998	Annex I Birds Directive W&C Act Schedule 1 RSPB Amber List
Hen harrier *Circus cyaneus*	Dry heath (roost), feeds over heathland, farmland	Declining numbers in last 20 years, from 15 birds each winter down to around two to five birds per year for the last five years, rare	Annex I Birds Directive W&C Act Schedule 1 RSPB Red List
Honey buzzard *Pernis apivorus*	Woodland	Three to six breeding pairs, rare	Annex I Birds Directive W&C Act Schedule 1 RSPB Amber List
Kestrel *Falco tinnunculus*	Woodland edge/heathland	Regular breeder, infrequent	RSPB Amber List
Hobby *Falco subbuteo*	Heathland	Four breeding pairs, rare	W&C Act Schedule 1 RSPB Green List

Species	Habitat	Distribution	Protection/status
Merlin *Falco columbarius*	Heathland	Overwinters, scarce	Annex I Birds Directive W&C Act Schedule 1 RSPB Red List
Goshawk *Accipiter gentilis*	Woodland and heathland	Regular breeder. 40+ pairs	Annex I Birds Directive W&C Act Schedule 1 RSPB Green List
Black grouse *Tetrao tetrix*	Heathland	Extinct in New Forest since 1930s	Annex I Birds Directive RSPB Red List
Ringed plover *Charadrius hiaticula*	Dry grassland/Bare stony ground	Very rare breeder	RSPB Red List
Lapwing *Vanellus vanellus*	Valley mires/Wet grassland/Permanent and temporary ponds	Regular breeder but declining numbers, 69 pairs in 2019. (This may have been due to exceptional weather. Previous surveys: 85 (1994), 117 (2004), 134 (2014).)	RSPB Red List
Curlew *Numenius arquata*	Valley mires/Wet grassland/Permanent and temporary ponds	Regular breeder. Declining numbers. Attempts to breed but often unsuccessful. 40 pairs in 2019. (Previous surveys: 18 (1994), 14 (2004), 13 (2014).)	RSPB Red List
Redshank *Tringa totanus*	Valley mires/Wet grassland/Permanent and temporary ponds	Regular breeder. Declining numbers. Attempts to breed but often unsuccessful. Seven pairs in 2019. (Previous surveys: 156 (1994), 111(2004), 100 (2014).)	RSPB Amber List
Snipe *Gallinago gallinago*	Valley mires/Wet grassland/Permanent and	Regular breeder. 102 drumming males in 2014. Planned survey in 2020	RSPB Amber List

Species	Habitat	Distribution	Protection/status
	temporary ponds		
Nightjar *Caprimulgus europaeus*	Heathland mosaic	500+ breeding pairs	Annex I Birds Directive RSPB Amber List
Kingfisher *Alcedo atthis*	Rivers and streams	Up to 10 pairs, uncommon	Annex I Birds Directive W&C Act Schedule 1 RSPB Amber List
Wryneck *Jynx torquilla*	Woodland	Extinct, last breeding record in 1940s	W&C Act Schedule 1 RSPB Red List
Lesser spotted woodpecker *Dendrocopos minor*	Woodland	Regular breeder. Widespread at low density	RSPB Red List
Green woodpecker *Picus viridis*	Woodland/Grassland mosaic	Regular breeder	RSPB Green List
Dunnock *Prunella modularis*	Woodland edge/Scrub	Regular breeder	RSPB Amber List
Skylark *Alauda arvensis*	Heathland/Grassland	Regular breeder, widespread	RSPB Red List
Woodlark *Lullula arborea*	Dry heath/Dry grassland	169 breeding pairs, rare. (Previous surveys: 182 (1997), 163 (2008), 134 (2014).)	Annex I Birds Directive W&C Act Schedule 1 RSPB Green List

Species	Habitat	Distribution	Protection/status
Nightingale *Luscinia megarhynchos*	Woodland edge/dense scrub	No longer present in New Forest	RSPB Red List
Redstart *Phoenicurus*	Woodland	Regular breeder, widespread and common	RSPB Amber List
Stonechat *Saxicola torquata*	Dry heath	Regular breeder, common	RSPB Green List
Song thrush *Turdus philomelos*	Grassland	Regular breeder, common	RSPB Red List
Grasshopper warbler *Locustella naevia*	Heathland	Very low numbers now and perhaps none breeding	RSPB Red List
Dartford warbler *Sylvia undata*	Dry heath	250 pairs in 2018 survey (after a bad winter). Previous surveys: 535 (1997), 422 (2006), 268 (2014). While these surveys indicate a decline over the last 20 years, this needs to be treated with caution. The population is known to fluctuation significantly in response to prevailing weather conditions each winter	Annex I Birds Directive W&C Act Schedule 1 RSPB Amber List
Firecrest *Regulus ignicapillus*	Woodland	Population increasing, widespread in conifer and broadleaf woodlands	W&C Act Schedule 1 RSPB Green List
Marsh tit *Poecile palustris*	Woodland	Regular breeder. Current status unknown; possible declining population.	RSPB Red List
Starling *Sturnus vulgaris*	Woodland/grassland	Regular breeder. Widespread but low numbers	RSPB Red List
Goldfinch	Woodland/grassland	Regular breeder. Increasing population in recent years	RSPB Green List

Species	Habitat	Distribution	Protection/status
Carduelis			
Red-backed shrike *Lanius collurio*	Woodland edge	Extinct as breeder in Forest since 1978	W&C Act Schedule 1 RSPB Red List
Hawfinch *Coccothraustes*	Woodland	Population stable	RSPB Red List
Bullfinch *Pyrrhula*	Woodland	Population stable, widespread	RSPB Amber List
Linnet *Carduelis cannabina*	Heathland	Regular breeder. Numbers reduced on previous years as no longer abundant	RSPB Red List
Crossbill *Loxia curvirostra*	Woodland	Regular breeder, population stable, common	W&C Act Schedule 1 RSPB Green List
Wood warbler *Phylloscopus sibilatrix*	Woodland	Breeder, population declining. 40-44 singing males recorded in the Forest in 2018	W&C Act Schedule 1 RSPB Red List

Dartford warbler *Sylvia undata*

Distribution and status

Resident and largely restricted to heathland in the United Kingdom, with the European population (representing the vast majority of the global population) being at its northwestern extremity. National surveys of the UK breeding population of Dartford warbler were undertaken in 1974, 1984, 1994 and 2006. The sampling methodology and data recording has varied slightly between years. Fearnley et al (2012) provide a summary of New Forest populations in the context of national populations recorded during national surveys. The 2006 survey recorded 420 territories within the SPA (13.3% of the national population).

In 2014 the New Forest population survey commissioned through the HLS scheme found 268 territories. Using the last available national population estimate (3,142 territories in UK in 2006) the New Forest territories represent 8.5% of the national population (Gates 2014; New Forest Dartford Warbler Survey).

The New Forest population assessment in 2018 (Hampshire Ornithological Society) estimated the population at 250 pairs. This is a further decline on previous estimates, in large part attributable to the harsh winter of 2017-18. Previous New Forest surveys recorded 535 (1997), 422 (2006) and 268 (2014). While these surveys indicate a decline over the last 20 years, this needs to be treated with caution. The population is known to fluctuate significantly in response to prevailing weather conditions each winter.

In the last 25 years the national population of this species has almost doubled to 3,200 pairs, with birds now breeding further north in England and in a wider variety of habitats. This success story has a allowed the UK conservation status of Dartford warbler to be changed from Red to Amber on the list of Birds of Conservation Concern (BOCC). However, this success has not been mirrored at the local level in the New Forest.

Ecology

Dartford warbler typically occurs on dry heathland which supports mosaics of *Ulex europaeus* and *Calluna vulgaris/erica* spp. in which they nest between mid-April and early July. Birds nesting early in the season may attempt a second or even a third brood. Gorse is particularly important in providing habitat for prey items (beetles, spiders, caterpillars and bugs) and in winter provides protection from extreme weather conditions to which the population is highly susceptible. In Britain, Dartford warblers are largely sedentary, although some disperse outside the breeding

season. These movements (combined with increasingly mild winters and good breeding seasons) have enabled the population to expand and recolonise many formerly occupied sites.

Habitat requirements

The optimum Dartford warbler habitat comprises extensive mature dry heath (dense heather of 10-30 years old) over 30cm long, with scattered dense *Ulex europaeus* brakes of around 1-2m high away from the woodland edge. The proportion of gorse to heather largely controls territory density and breeding success is highest in the average territory of some 2.13ha, when gorse, in suitable condition, comprises 0.6ha (or about 28%) of the cover. Minimum area of suitable habitat is around 2.5ha but blocks of 10ha are preferred. In the Forest, when optimal habitat is at saturation and the population is expanding, pairs will utilise sub-optimal habitat such as gorse brakes on dry acid grassland (which lack the *Erica*ceous component) or dry heath with very little gorse.

Open Forest grazing and rotational heather burning management is ideal, though periodicity and timing of burning operations is important. Heather stands need sufficient time to develop optimal structure (which can in the presence of grazing animals be between 15-30 years in the Forest) and burning must avoid the critical winter period and the start of the breeding season—thus February/March is preferred. Gorse stands should be managed on a 15 to 20-year rotation (depending upon grazing pressure) to avoid senescence. Tree and bracken cover in excess of the percentages specified by Natural England for dry heath would result in sub-optimal conditions for Dartford warbler.

Monitoring

Habitat through condition assessment monitoring.

Bird counts through both national and local Dartford warbler surveys, on average every 8-12 years. These provide a snapshot which perhaps masks significant population fluctuations in intervening years.

Woodlark *Lullula arborea*

Distribution and status

Partial migrant, with the majority of population supported on heathland in the United Kingdom. The European population (representing the vast majority of the global population) is at its northwestern extremity. The most recent New Forest census

revealed 169 territories, which represents around 5.4% of the UK population, making New Forest heathland one of the most important sites for woodlark in the UK after Thetford Forest and the Suffolk Sandlings.

Previous New Forest surveys have recorded 182 (1997); 163 (2008); 134 (2014).

Ecology

Woodlark principal habitat requirement is an intimate mosaic of bare ground and short vegetation on sandy, well-drained soils. Scattered trees or shrubs are used as song perches. Spiders, weevils, caterpillars and seed-bearing plants are important food sources. In the breeding season some males take up territories as early as mid-February with breeding extending to early August; second broods are frequent. The nest is a shallow scrape, usually placed under a tuft of grass or heather, or dead vegetation from the previous season.

Habitat requirements

The optimum woodlark habitat is an intimate mosaic of bare ground and short vegetation up to 10cm in height, with occasional clumps of shrubs or trees. Due to their rather exacting habitat requirements, woodlark hold large territories of up to 4-5ha. In the New Forest, the transition between woodland edge and heavily grazed dry grassland/dry heath habitats is a typical location. The mix of bare ground, short (5cm) and very short (<5cm) vegetation and bracken litter maintained at these locations by the differential and preferential grazing behaviour of commoners' livestock is ideal.

Prescribed burning and cutting also produces more ephemeral sites for woodlark but they generally become unsuitable following two years re-growth. They are no substitute for the tight vegetation mosaic produced and maintained by grazing. Woodlark are also vulnerable from cutting and burning (and recreational disturbance) from mid-February until early August. The RSPB estimate that a safe working zone of 200m around occupied sites is necessary to avoid disturbance.

Monitoring

Habitat through condition assessment monitoring.

Bird counts through national woodlark surveys every 8-12 years.

Nightjar *Caprimulgus europaeus*

Distribution and status

Migrant which favours heathland for nesting and broadleaved woodland for feeding in the United Kingdom. The European population (representing approximately half the global population) is at its northwestern extremity. However, unlike woodlark and Dartford warbler, nightjar has a wider UK distribution, occurring as far north as south and southwest Scotland. The breeding population of nightjar in the New Forest in 2018 was 435, based on territorial males. This is equivalent to 9.3% of the UK population, based on the 2004 national survey identifying 4,606 territorial males.

A comparison of the number of territorial males from previous studies, both national and within the New Forest, suggest that there has been a decline in numbers with approximately 20% fewer territories identified than in the last survey in 2013 (reduction from 544 to 435). In addition, comparison with data from neighbouring nightjar sites of the Dorset and Thames Basin heaths indicates these populations are relatively stable compared with the New Forest population.

The 2018 survey suggests that nightjar numbers are declining in the Forest when compared to the 2004/05 and 2013 survey data, but that there has been a slight expansion in range. However, the number of territorial males (as a representation of breeding pairs) still exceeds the SPA target of 300 breeding pairs (8.8%) of the breeding population in Great Britain.

Ecology

Nightjar are ground nesting species, requiring sparsely vegetated or bare ground on heathland, woodland edges and clearings. They will forage (largely on moths and beetles) in habitats around the nest but can range up to 6km utilising a wide variety of habitats. They arrive in the UK in late April/early May leaving in August/September to winter in sub-Saharan Africa. They are particularly active after dusk and before dawn when their unusual ‘churring’ song and wing clapping can be heard.

Habitat requirements

Nightjar require a mosaic of heathland and wooded vegetation for breeding and feeding. In the New Forest they nest on sparsely vegetated or bare ground on dry heath/dry grassland with bracken mosaics, between mid-May and mid-July. There is considerable potential to cause significant disturbance to immature young birds during August—and so operations such as cutting of dense birch, bracken or tall heather stands should be avoided in known breeding sites. They are also vulnerable

to recreational disturbance during this period.

Nightjar feed over a broad range of habitats including open heath, mire, pasture woodland and grassland. Hence the juxtapositions of these habitats and transitions between them, maintained by livestock grazing, prescribed burning and cutting are essential.

Monitoring

Habitat through condition assessment monitoring.

Bird counts through National Nightjar Survey (last in 2004) and supplementary surveys (2005, 2013 and 2018), on average every 8-12 years.

Hen harrier *Circus cyaneus*

Distribution and status

Overwinters in the New Forest, roosting on heathland and feeding over a wide area of Forest and farmland habitats. Roost numbers have declined, with two to five individuals per year for the last five years. There are currently no national figures for wintering population to provide context. There are potentially a number of reasons for fewer birds in the New Forest in recent years, including susceptibility to disturbance, milder winters, reduced management options for maintaining extensive blocks of mature heather. Beyond the New Forest and the UK, there is potentially also a decline in the population across northwestern Europe.

Ecology

A ground nesting species in northern and western British Isles which migrates south arriving in the New Forest in the autumn (September onwards). Birds feed on avian prey especially pipits on heathland but spend much feeding time off the Forest on adjacent farmland where prey is more available.

Habitat requirements

Hen harrier roost in extensive deep heather. Sites may be used year after year if they remain in suitable condition. The cut and burn programme clearly has the ability to strongly influence condition of harrier roost sites and it is important that sufficient deep heather remains in favoured roost areas. Prey items include small- to medium-sized mammals like voles and rabbits, as well as birds like pipits and pigeons—though much prey is sought off the Forest.

Monitoring

Habitat through condition assessment monitoring.

Bird counts through watching roost sites. For the last two seasons the roost has been monitored by the Hampshire Ornithological Society.

Hobby *Falco subbuteo*

Distribution and status

Hobbies now breed across northern, central, southern and eastern England, southern Scotland and south Wales. They return rather late in the year to their English breeding grounds, arriving from early May to early June and breeding during June and July. European breeding birds winter in southern and, probably, west Africa.

Hobby are a notable summer visitor to New Forest heathlands, with a target population of over 25 breeding pairs, in line with the population size at the time of SPA designation. Around 2,800 pairs now breed in the UK (RSPB, 2022).

Classified in the UK as Green under the Birds of Conservation Concern 4: the Red List for Birds (2021). Protected in the UK under the Wildlife and Countryside Act, 1981.

Ecology

A small falcon that measures around 32-36cm in length with a wingspan of 75-88cm, hobbies have a streaked white and brown breast with reddish thighs that look like ‘trousers’. Their wings are long and narrow, especially relative to their small size.

Hobbies do not build nests but use the abandoned nests of carrion crows and other raptors on the edges of woodland, in isolated clumps of trees and in hedgerows. A wide range of trees are used, though Scots pine is preferred on southern heathlands (Tubbs, 1986). Breeding territories tend to be traditional, though the actual nest site may alter between years.

Clutches usually consist of three brown eggs with darker markings and are laid in June. Chicks are fed by both parents and the young fledge in mid-August and are able to catch their own insect prey after two or three weeks but remain dependent on their parents for another five weeks.

Hobbies hunt for both avian and insect prey and in the New Forest have been observed to take young house martins and swallows to feed their young. The other main prey items for hobby are large aerial insects, notably *Odonata*, day-flying moths, butterflies and beetles.

Habitat requirements

Hobbies rely on open areas for hunting but will use trees and open woodland for breeding. They are often found close to flooded gravel pits and other wetland habitats, taking advantage of the large number of dragonflies.

Monitoring

The national status of hobby has changed significantly in recent years with them spreading north into farmland and now breeding in southern Scotland. While this change has taken place the number of pairs breeding in the Forest has declined in the past decade. Four pairs were known to breed in 2020. The reasons for the decline here have been attributed to the increase in breeding goshawks and although predation by goshawk has been witnessed this is probably only a contributing factor. The decline in house martins locally, which was an important food resource when feeding their young may be more significant, as well as a possible decline in invertebrates such as moths.

Woodland birds

The New Forest supports an exceptionally rich breeding bird fauna, related to the extent and habitat diversity of the broadleaved woodland cover. In particular open wood pasture with old trees rich in crevices and rot holes provide extensive habitat for woodpeckers (great-spotted, lesser-spotted and green), tree creeper, nuthatch, tits (blue, great, coal, long-tailed), spotted flycatcher, tawny owl and redstart. Woodland floor specialists include woodcock, tree pipit and wood warbler, the latter of which has seen a dramatic decline in numbers in part due to nest predation in the Forest but also due to factors during migration and their wintering grounds (Mallord et al, 2012; Whytock et al, 2015; Juliet et al, 2014). Where the shrub layer is sufficiently well developed, large numbers of common species occur including chaffinch, wren, robin, blackbird, song thrush, bullfinch, dunnock, chiffchaff, blackcap, garden warbler, greenfinch, goldfinch and linnet.

The introduction of coniferous forestry into the Inclosures has encouraged the arrival of firecrest and crossbill where conditions are suitable.

Raptors breeding in the Forest woodlands include buzzard, honey buzzard (see below), kestrel, sparrowhawk and more recently goshawk. Prey items related to the paucity of heathland birds and the relative scarcity of small mammals (in turn related to a certain homogeneity of grassland sward heights) would appear to be the main limiting factors of raptor population densities (Tubbs, 1986).

One woodland species, wryneck, has become extinct as a breeding bird in the New Forest within living memory, having last bred pre-1940. Presumably its extinction is related to its overall contraction in range at a European scale.

Those birds of recognised conservation concern are listed against their preferred habitats with an indication of status where known in Table 19. The Forest is designated as a Special Protection Area (SPA) for certain heathland species (breeding Dartford warbler, nightjar and woodlark and overwintering hen harrier) and for honey buzzard, a species of broadleaved woodland and parkland.

Honey buzzard *Pernis apivorus*

Distribution and status

Migratory; breeding in Europe while wintering in central-southern Africa. Three to six pairs regularly breed in woodland in the New Forest, representing 7-14% of the total UK breeding population.

Ecology

A species of mature woodland and open glades and meadows. Birds migrate to tropical Africa during late August to mid-September, returning in May to breed. Honey buzzard either make their own nest or develop it from old nests, favouring mature trees such as beech, oak, Scots pine or Douglas fir. They feed on bees, wasps and other insect larvae which they dig from suitable soils. Apart from wasp larvae they will take frogs, birds and other small prey and forage over large distances (up to 10km).

Habitat requirements

Large blocks of woodland within a mosaic of open countryside with smaller copses and meadows are favoured. The availability of preferred prey is probably the key factor. Avoidance of disturbance during nesting, particularly from intrusive forestry operations at or near the nest site is crucial.

Monitoring

Habitat through condition assessment monitoring.

Annual monitoring/surveillance of New Forest birds to prevent disturbance from forestry operations.

Wood warbler *Phylloscopus sibilatrix*

Distribution and status

A summer visitor to the New Forest, wintering in the forests and woodlands of sub-Saharan and equatorial Africa. Much of the population in Europe is found in forested lowlands, though in the UK it is predominantly found in western oak woods of Devon, Somerset, Wales and the uplands. However, the grazing management of New Forest woodlands also creates suitable breeding habitat by maintaining the open understory, preventing the development of shrubs and herbaceous vegetation and producing a ground layer dominated by grasses.

Classified in the UK as Red under the Birds of Conservation Concern 4: the Red List for Birds (2021). Protected in the UK under the Wildlife and Countryside Act, 1981.

Ecology

The wood warbler has bright yellow upper parts, throat and upper chest and white under parts. It is one of the largest *Phylloscopus* warblers in Europe, measuring 12-13cm in length with a wingspan of 19.5-24cm. Wood warblers are largely insectivorous, eating caterpillars, flies, moths, beetles, aphids and spiders, though fruit and seeds are also taken in the autumn.

The majority of birds arrive during May, constructing nests on the woodland floor and laying clutches of five to seven eggs in the second half of May and in June. Chicks fledge when they are around 13 days old.

Birds begin to leave their breeding areas in late July with most departing during August. Wood warblers are rarely found in any numbers away from the breeding areas and few birds linger until October.

Habitat requirements

Wood warblers are associated with well-wooded landscapes and favour sub-mature and mature, usually oak dominated, woodlands. They prefer relatively closed-canopy

woodlands with varied sub-canopy structure, relatively sparse understorey and some field layer vegetation.

Wood warblers need some perches 1-2m above the ground on approach to the nest but also need to have no visual obstruction so that they scan for predators on approach. They nest on or close to the ground, often on slopes, in relatively open ground vegetation with some cover (grass tussocks, sparse bramble, ferns, heavy leaf litter or fallen branches).

Monitoring

The UK breeding population stands at 6,500 males but is declining across much of its UK range and has seen a dramatic decline in the New Forest. An email (Betton, 2018; personal communication) provided data for a total of 40-44 singing males recorded from 14 localities in the New Forest. The number of locations was the same as in 2017, following significant declines in previous years, but the number of individuals continued to decline. The decline is thought to be in part due to nest predation but there is also evidence to indicate that the factors causing the decline are away from the breeding areas and operating on migration or the wintering grounds.

New Forest amphibians and reptiles

Amphibians

Great crested newts *Triturus cristatus* are a Qualifying Feature of the New Forest SAC. Tubbs (1986), Clarke (1989) and Cooke (1989) review the amphibian survey data collected on the New Forest Crown Lands over the past century and related distribution to pond acidity, nutrient status and vegetation cover.

Five native species regularly occur: palmate newt *Triturus helveticus*, smooth newt *T. vulgaris*, great crested newt *T. cristatus*, common frog *Rana temporaria* and common toad *Bufo bufo.* Natterjack toad *B. calamita*, never widespread in what are sub-optimal habitat conditions for this species in the Forest, appear to have become extinct (in line with the national decline) around 1950. There are no current plans for its reintroduction; indeed the combination of suitable terrestrial and aquatic habitat would be difficult to find or create. There is at least one population of non-native tree frog *Hyla arborea*, introduced in the early part of the 20th century.

Common frog and common toad are fairly frequent throughout the SAC, occurring in suitable pools in both woodland and heathland situations. Cooke and Frazer (1976) record that common frog has the wider tolerance of pool acidity (pH 4.2-8.2) in the Forest, common toad preferring near neutral ponds.

Clarke (1989) records that of 139 New Forest ponds surveyed over the previous 25 years, about half supported newt colonies. Palmate newt was found in 45% of all ponds surveyed and is evenly distributed across the Forest, reflecting the tolerance of this species to low pH (down to 3.9) and preference for metal deficient pools especially those poor in potassium (Cooke and Frazer, 1976). Smooth newt is mainly confined to the more nutrient-rich, higher base status pools (above pH 6) in the southern part of the Forest, being present in 25% of all ponds surveyed (Clarke, 1989). While separated by water chemistry, both occur in ponds with the same physical characteristics preferring ponds above 100m2 and those with abundant aquatic plants. The great crested newt is of particular significance at the European level, being one of the Qualifying Features for which the New Forest is designated a SAC. The requirements and distribution of the Annex II species great crested newt is described in greater detail below.

Great crested newt *Triturus cristatus*

Distribution and status

Clarke (1987) records that of 139 New Forest ponds surveyed over the previous 25 years, great crested newt was found in just seven of them. This is a reflection of the more demanding habitat requirements of this species, which shows a marked distribution restricted along the southern edge of the Forest. More recent survey has revealed some 13 sites with an estimated population of between 500-1,000 individuals (Davidson-Watts, 2000; personal communication).

Ecology

Adult male and female great crested newts spend at least half of each year on terrestrial habitats, returning to water briefly for courtship and egg laying in the years of reproductive prime. Furthermore, newly metamorphosed newts leaving a pond at the end of their first year will not return to water until sexually mature which may take up to four years to achieve (Macgregor, 1995). Hence, the terrestrial element of the species habitat is of vital importance—this should provide cool, moist conditions for shelter and feeding. Adults normally return to water in late March or early April and leave again at any time after mid-July, when weather conditions are favourable (not too cold or too dry). Suitable ponds should be numerous and not too far apart to prevent inbreeding. Evidence in a Leicestershire study (Arntzen, 1993) suggests that adults may move considerable distances (500m-1.1km) between ponds.

Habitat requirements

Similar to smooth newt in its water chemistry tolerance (above pH 6, with a high calcium and potassium content), but favouring ponds with a high proportion of open water surface and deeper water, perhaps because the newly hatched larvae require deep water. Nutrient levels should be sufficient to produce good aquatic plant growth, but insufficient to stimulate extensive green filamentous algae. Invasion and swamping by *Crassula helmsii* is a further negative attribute. Predation by fish on larvae is critical; this species will only thrive in ponds where fish are absent. Great crested newt may use larger temporary ponds which are unsuitable for fish, provided that they contain water over the breeding/tadpole season (February to mid-August) for at least one in every three years. Slight shading is beneficial, particularly on the northern edge of the pond, but becomes unfavourable when in excess of 25% on the southern margins or 50% overall (Cooke et al, 1994). Extensive structurally diverse pasture woodland or heathland habitats (particularly grassland with scrub) are required adjacent to the key breeding ponds.

Monitoring

Determine baseline of population and key ponds, followed by five-year counts.

Habitat by condition assessment of key ponds.

Reptiles

All six species of native reptiles occur in both heathland and wood pasture habitats in the New Forest, namely smooth snake *Coronella austriaca*, grass snake *Natrix natrix*, adder *Vipera berus*, slow worm *Anguis fragilis*, common lizard *Lacerta vivipara* and sand lizard *Lacerta agilis*. Of these, sand lizard is the only species confined to heathland habitats.

Always restricted due to the lack of optimum habitat, it is thought that sand lizard became extinct in the New Forest as a breeding species in the early 1970s, although there is little in the way of records to support this, the only known record of sand lizard is from the west of the New Forest. Noble (1998) suggests that the contributory factors in this decline (from 22 sites in the 1950s) may have been loss of habitat due to the planting or self-seeding of Scots pine; and post-myxomatosis decline in rabbits who were providers of bare sandy substrate, which resulted in a lack of sufficient bare sand for egg laying. Subsequently 766 individuals have been re-introduced to five sites into the New Forest, under a release scheme beginning in 1989. Post-release monitoring has revealed that successful breeding and establishment have

occurred at three sites: Markway and Dur Hill Inclosures and Hasley heath (Noble, 2019; personal communication).

Sand lizard is oviparous, laying its eggs in loose, sandy soil in early summer and habitat in optimal condition for this species is limited in the New Forest to dry heath (NVC H2a communities) with mature (30-year-old plus *Calluna vulgaris*) with plentiful dry sandy bare patches on south-facing slopes. Such stands do not produce a flush of *Molinia* and so regular prescribed burning to improve livestock forage is pointless and longer rotations avoiding population centres could be implemented through appropriate planning and an element of education. In addition, optimum habitat could potentially be restored following conifer clearance from the Verderers' Inclosures.

Smooth snake has less demanding habitat requirements than sand lizard, utilising the full range of heathland and woodland edge habitats. It is also far more widespread and better able to cope with Open Forest heathland management regimes.

Amphibians, reptiles and the law

All of the native species of amphibian and reptile receive at least some degree of protection under Schedule 9 of the Wildlife and Countryside Act (1981) as amended, Section 41 of the Natural Environment and Rural Communities Act 2006 and (for sand lizard, smooth snake and great crested newt) Section 39 of the Conservation of Habitats and Species Regulations 2010 (as amended, 2017 [the Habitats Regulations]). Three levels of protection apply:

Sand lizard, smooth snake and great crested newt

Fully protected against deliberate killing, injuring or taking (capturing, etc.), possession, disturbance and destruction of breeding, resting and sheltering places, sale, barter, exchange, transporting for sale and advertising to sell or to buy.

Common lizard, slow worm, grass snake and adder

Protected against deliberate killing, injuring and trade (i.e. sale, barter, exchange, transporting for sale and advertising to sell or to buy).

Smooth newt, palmate newt, common frog and common toad

Protected against trade (i.e. sale, barter, exchange, transporting for sale and advertising to sell or to buy).

Exceptions

An important defence to any prosecution that might be brought is the exception that where the killing, injuring or taking, disturbance and destruction of breeding, resting and sheltering places, has occurred inadvertently as an incidental result of a lawful operation by an authorised person (i.e. the owner or occupier or any person authorised by the owner or occupier), no offence has been committed. All recognised forest and heathland management operations are lawful and although these can be carried out at times of year when reptiles (in particular) are vulnerable, the spirit of the Act is clear: **the needless and deliberate destruction of protected species is unacceptable and the onus is on the owner to carry out operations in a reasonably sensitive way.** Generic advice on good practice woodland management in the presence of European Protected Species (such as great crested newt, sand lizard and smooth snake) is available. In the context of the New Forest, further advice on planning to avoid disturbance is given below.

Planning of habitat management to avoid killing, injuring or disturbance to protected species

In the New Forest the routine management operations conducted in woodland and in heathland are unlikely to affect great crested newt or the more widespread species. (However, should operations be considered necessary in known great crested newt habitat then careful planning and survey will be required.) The principal issue lies with heathland burning and hibernating reptiles.

The legally permitted burning period is 1 November to 31 March. A licence granted by Natural England is required to burn outside of the burning season or to burn more than 10ha in a single burn. During this period reptiles hibernating in burrows at the time may escape the effects of fire as litter and soil layers provide excellent heat insulation and the rise in temperature only a few centimetres below the surface during a well-managed fire is minimal. However, in warm ‘early’ springs reptiles may have come out of hibernation before the end of the burning season and will be extremely vulnerable to fire.

In such cases careful preliminary searches should be made of known reptile sites to check for active animals and sensitive areas should be avoided. Burning of the driest heathland communities (NVC H2a communities) should not be countenanced in March at known sand lizard population centres.

New Forest fish

No fish species are Qualifying Features of the New Forest SAC but it contains a network of small streams which form an unusual community which results from the combination of nutrient-poor, acid waters and outcrops of neutral enriched soils. The Lymington River system is the largest in the New Forest and includes two contrasting tributaries: the Ober Water and Highland Water. Of the 42 native and 13 introduced freshwater species in the UK fish fauna, 20 have been recorded in New Forest streams and rivers (e.g. Lymington River) including bullhead *Cottus gobio* and brook lamprey *Lampetra planeri* (both species listed on Annex II of the Habitats Directive), European eel *Anguilla anguilla* and brown trout *Salmo trutta.*

The bullhead is a small bottom-living fish found in the upper reaches of lowland rivers. It is not present in polluted rivers. The brook lamprey is a primitive, jawless fish resembling an eel and is the smallest of the lampreys found in the UK. It lives entirely in freshwater. European eel populations have declined by 95% since 1980, they are a species of principal importance under NERC Act and protected by the Eel Regulations 2009. Brown/sea trout are also Species of Principal Importance under NERC Act, protected under the Salmon and Freshwater Fisheries Act 1975. Climate change is likely to have a major impact on this species due to low flows earlier in the year as well increasing air and water temperatures.

New Forest invertebrates

The New Forest is a rich and complex ecosystem with a myriad of species. It is important to remember that this document is a management plan; and that the management enshrined in this plan broadly replicates that which has occurred in the Forest for the past few hundred years. The cautious assumption that can therefore be made is that the species present (and for which the Forest is so highly prized) are here because of, rather than in spite of, the past and present management regimes. For example, recent ad hoc surveys reveal outstanding diversity of invertebrate species on grazed environments such as Fort Bog, Matley and Shatterford.

That said, site managers should be aware that new discoveries about existing ecology of species, or new species discovered, may exceptionally require some fine-tuning of the broad management approach.

Since 2000 there has been an enormous interest in recording invertebrates and other taxa in the SAC. Consequently, there exists a lot of raw data which requires further work to properly catalogue, verify and analyse.

Hence, while it was possible to give a definitive list of species (classified rare and notable) in the First edition, it is not possible nor necessary to update the existing tables in this edition. Furthermore, it is now possible to give access to this data electronically (a facility now available due to technological advancement). Interested parties should in the first instance contact Hampshire Biodiversity Information Centre.

The text for the species for which the SAC was designated has been updated where new information exists.

N.B. UK BAP Priority Species were those that were identified as being the most threatened and requiring conservation action under the UK Biodiversity Action Plan (UK BAP). The original list of UK BAP Priority Species was created between 1995 and 1999. As a result of devolution and new country-level and international drivers and requirements, much of the work previously carried out by the UK BAP is now focussed at a country-level rather than a UK-level; and the UK BAP was succeeded by the 'UK Post-2010 Biodiversity Framework' in July 2012. Today the UK list of Priority Species remains an important reference source and has been used to help draw up statutory lists of Priority Species in England, as required under Section 41 of the Natural Environment and Rural Communities Act 2006. For further information refer to the JNCC website.

The New Forest supports an enormous diversity of invertebrate species and two are Qualifying Features of the New Forest SAC; stag beetle *Lucanus cervus*, which is the UK's largest terrestrial beetle; and southern damselfly *Coenagrion mercurial*, where the New Forest is an outstanding locality for this species.

Tubbs (1986) estimates that roughly half of all British insects occur in the New Forest. Such diversity is supported by the extensive woodland and heathland habitats described elsewhere. However, such habitats alone could never accommodate the wealth of invertebrate fauna present in the New Forest. It is the structural diversity and intimate mosaic with vast areas of transitional edge habitats which diversify the interest.

Only a highly superficial description is possible here and that is restricted to dealing with invertebrates of conservation concern. These are listed in Tables 20 and 21 together with their habitat preferences. Some are listed as Priority Species in the UK BAP and may have current or planned Species Action Plans either at UK or county level under Section 41 of the NERC Act 2006.

Management principles and a cautionary note

In the context of the New Forest it is likely that the habitat needs of the bulk of the staggering diversity of invertebrate species are sufficiently accommodated by current management. The exceptions are those dependent upon more structurally diverse and flower-rich woodland habitats—particularly the *Lepidoptera* and those associated with wetland habitats which have suffered drainage damage. The importance of bare sandy ground in dry heathland and structurally mature/old *Calluna* stands should be emphasised here also, particularly in the context of many rare heathland *Hymenoptera* and *Coleoptera*. It is also pertinent to point out that the distribution and autecological requirements of most of the New Forest species of conservation concern are very poorly understood.

Sterling (1997) has grouped the heathland species under sandy open ground species; dry heathland species; humid and wet heathland species; heather feeders showing little preference for heathland type; mires and seepages; temporary pools and shallow ponds; scrub and heathy woodland edge; and dead wood and fungal associates. Likewise, a similar grouping could be produced for woodland invertebrates, which would include canopy, scrub and field layer specialists, dead standing and fallen wood and fungal associates, wet swampy woodland, glade and bare ground specialists.

The key point is that all of these habitats need to be present in a suitable condition and in sufficient quantity and distribution to enable all species access to all habitat niches at all times depending on whatever developmental stage they are at. It is important to understand that development from egg to adult may require a variety of different habitats or structural niches at different stages of the development cycle over a number of years. While the New Forest is probably big enough to accommodate and maintain this range of habitat diversity, opportunities to promote further structural and floristic diversity particularly along Inclosure woodland and heathland edge habitats should be taken. In this context the New Forest Forest Plan (2019-2029) which will promote vastly improved management of the Crown Lands Inclosures and will provide enormous benefits for a whole range of invertebrates of conservation concern, is currently disadvantaged by higher grazing pressure.

Table 20: New Forest invertebrates by group and status (2001 data)

Primary habitat	Status	*Lepidoptera*	*Odonata*	*Coleoptera*	*Hymenoptera*	*Diptera*	*Orthoptera*	*Hemiptera*	*Araneae*	*Crustacea*	*Annelida*	*Mollusca*
Woodland	RDB 1	4	-	5	1	1	-	1	-	-	-	-
	RDB 2	1	-	2	-	9	-	-	-	-	-	-
	RDB 3	8	-	12	-	10	-	1	-	-	-	-
	RDB K	-	-	5	-	2	-	-	-	-	-	-
	Notable A	8	-	24	1	-	1	-	-	-	-	-
	Notable B	65	-	73	1	10	3	1	-	-	-	-
	Notable	-	-	10	-	17	-	-	-	-	-	-
	Total	86	0	131	3	49	4	3	0	0	0	0
Heathland	RDB 1	3	-	11	4	6	1	-	-	1	-	-
	RDB 2	2	1	4	3	4	1	-	-	1	-	-
	RDB 3	4	-	11	17	18	1	4	1	-	1	1
	RDB K	-	-	1	1	-	-	-	-	-	-	-
	Notable A	8	-	10	5	-	2	-	-	-	-	-
	Notable B	30	4	65	7	23	3	2	-	-	-	-
	Notable	-	-	7	-	-	-	-	-	-	-	-
	Total	47	5	109	37	51	8	6	1	2	1	1
	H+ W Total	133	5	240	40	100	12	9	1	2	1	1

Table 21: Significant invertebrate heathland and woodland species sorted by group and status (2001 data)

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Temporary ponds	*Annelida*	*Hirudo medicinalis*	Temp pools used by vertebrates	IUCN LR/NT Annex 5	RDB 3 Sch 5	yes	yes
Dry heath	*Araneae*	*Haplodrassus umbratilis*	Pioneer and mature dry heath		RDB 3		
Permanent ponds	*Coleoptera*	*Acylophorus glaberrimus*	Among semi-aquatic vegetation		RDB 1		
Temporary/permanent ponds	*Coleoptera*	*Aphodius niger*	Dung around pond edges		RDB 1	yes	yes
Permanent ponds	*Coleoptera*	*Bagous brevis*	Pool edges with *Ranunculus*		RDB1		
Permanent ponds	*Coleoptera*	*Bagous czwalinai*	Heathland pools		RDB1		
Permanent ponds	*Coleoptera*	*Gyrinus natator*	Acid pools		RDB 1		
Dry grassland	*Coleoptera*	*Heptaulacus testudinarius*	In pony/cattle dung		RDB 1		
Temporary ponds	*Coleoptera*	*Longitarsus nigerrimus*	Temp pools with *Utricularia*		RDB 1		
Mires	*Coleoptera*	*Pterostichus aterrimus*	*Sphagnum* bogs/acid pools		RDB 1	yes	
Dry heath	*Coleoptera*	*Pterostichus kugelanni*	Dry sandy heathland		pRDB 1	yes	
Mires	*Coleoptera*	*Tachys edmondsi*	*Sphagnum* bogs with bare ground		RDB 1	yes	yes
Mires	*Coleoptera*	*Tachys walkerianus*	*Sphagnum* bogs with bare ground		RDB 1		
Rivers and streams	*Coleoptera*	*Agabus brunneus*	Streamside		RDB 2		
Mires	*Coleoptera*	*Cryptocephalus*	Wet heaths/bogs possibly associated with		RDB 2		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
		biguttatus	ant species				
Rivers and streams/permanent ponds	*Coleoptera*	*Graphodytes flavipes*	Heathland ponds and slow-flowing water		RDB 2		
Wet heath	*Coleoptera*	*Hydroporus rufifrons*	Wet flush		RDB2		
Dry heath	*Coleoptera*	*Acritus homoeopathicus*	Associated with the fungus *Pyronema confluens*/burnt ground		RDB 3		
Dry heath	*Coleoptera*	*Amara famelica*	Dry sandy heathland		RDB 3	yes	
Permanent ponds	*Coleoptera*	*Bagous colligensis*	In heathland pools		RBB 3		
Permanent ponds	*Coleoptera*	*Bagous frit*	Heathland pools		RDB 3		
Wet grassland	*Coleoptera*	*Cantharis fusca*	Wet grassland with scrub		RDB 3		
Rivers and streams	*Coleoptera*	*Dryops striatellus*	In slow-flowing or stagnant water		RDB 3		
Permanent ponds	*Coleoptera*	*Enochrus isotae*	In heathland pools		RDB 3		
Permanent ponds	*Coleoptera*	*Haliplus variegatus*	Ponds		RDB 3		
Wet heath	*Coleoptera*	*Helophorus logitarsis*	Wet heath with *Sphagnum*		RDB 3		
Rivers and streams	*Coleoptera*	*Ocydromia melanopleura*	Larvae viviparous, unknown		RDB 3		
Mires/wet heath	*Coleoptera*	*Paederus caligatus*	Among vegetation on wet heaths		RDB 3		
Wet grassland	*Coleoptera*	*Atheta nannion*	Wet places/vegetation/riverbanks largely unknown		RDB K		
Dry heath	*Coleoptera*	*Anisodactylus nemorivagus*	Dry sandy heaths		Notable A	yes	
Dry grassland	*Coleoptera*	*Bledius femoralis*	Grassland		Notable A		
Dry heath	*Coleoptera*	*Calomicrus circumfuscus*	Heath with gorse		Notable A		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Dry heath	*Coleoptera*	*Exapion genistae*	In genista seed pods		Notable A		
Temporary ponds	*Coleoptera*	*Helophorus alternans*	In heathland pools		Notable A		
Rivers and streams	*Coleoptera*	*Hydrovatus clypealis*	Rivers		Notable A		
Dry grassland	*Coleoptera*	*Longitarsus quadriguttatus*	In grassland		Notable A		
Wet grassland	*Coleoptera*	*Neophytobius muricatus*	Wet grassland		Notable A		
Mires/wet grassland	*Coleoptera*	*Philonthus atratus*	Found in *Sphagnum* bogs and wet grassland		Notable A		
Rivers and streams	*Coleoptera*	*Quedius plancus*	River gravels		Notable A		
Dry grassland	*Coleoptera*	*Acrotrichis dispar*	In dung		Notable B		
Permanent ponds/rivers and streams	*Coleoptera*	*Agabus chalconatus*	In permanent shaded pools/stream sides in woodland		Notable B		
Temporary ponds	*Coleoptera*	*Agabus labiatus*	In stagnant temp pools		Notable B		
Dry grassland	*Coleoptera*	*Aphodius coenosus*	In pony/cattle dung		Notable B		
Dry grassland	*Coleoptera*	*Aphodius conspurcatus*	In pony/cattle dung		Notable B		
Dry grassland	*Coleoptera*	*Aphodius porcus*	In pony/cattle dung, a parasite of *Geotrupe* beetles		Notable B		
Dry grassland	*Coleoptera*	*Atomaria punctithorax*	In grassland		Notable B		
Permanent ponds	*Coleoptera*	*Bagous limosus*	In heathland pools		Notable B		
Dry heath	*Coleoptera*	*Bembidion nigricorne*	Heathland with *Calluna*		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Permanent ponds	*Coleoptera*	*Berosus affinis*	In heathland pools		Notable B		
Permanent ponds	*Coleoptera*	*Berosus luridus*	In ponds with rich vegetation		Notable B		
Permanent ponds	*Coleoptera*	*Berosus signaticollis*	In heathland pools		Notable B		
Permanent ponds	*Coleoptera*	*Blethisa multipunctata*	In marginal vegetation		Notable B		
Wet heath	*Coleoptera*	*Carabus nitens*	Wet heath with *Sphagnum*		Notable B		
Permanent ponds	*Coleoptera*	*Cercyon ustulatus*	At the edge of vegetated pools		Notable B		
Dry grassland	*Coleoptera*	*Ceutorhynchus rapae*	Associated with *Cruciferae*		Notable B		
Permanent ponds	*Coleoptera*	*Chaetarthria seminulum*	In marginal vegetation		Notable B		
Wet grass/Wet heath	*Coleoptera*	*Chaetocnema subcocerulea*	Wet grass/heath, probably associated with sedges and rushes		Notable B		
Permanent ponds	*Coleoptera*	*Chlaenius nigricornis*	In vegetation at pond edges		Notable B		
Dry grassland	*Coleoptera*	*Chrysolina orichalcea*	Associated with *Umbelliferae*		Notable B		
Rivers and streams	*Coleoptera*	*Deronectes latus*	In running water with *Frontalis*		Notable B		
Rivers and streams	*Coleoptera*	*Donacia crassipes*	Slow flowing water		Notable B		
Rivers and streams	*Coleoptera*	*Dryops auriculatus*	In slow flowing, or stagnant water		Notable B		
Rivers and streams	*Coleoptera*	*Dytiscus circumflexus*	In rivers and streams		Notable B		
Permanent ponds	*Coleoptera*	*Elaphrus uliginosus*	In marginal vegetation		Notable B		
Permanent ponds	*Coleoptera*	*Enochrus affinis*	In heathland pools		Notable B		
Rivers and streams	*Coleoptera*	*Graptodytes granularis*	In slow flowing or stagnant water		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Dry grassland	*Coleoptera*	*Gronops lunatus*	Associated with *Caryophyllaceaea*		Notable B		
Permanent ponds	*Coleoptera*	*Haliplus heydeni*	Well vegetated ponds		Notable B		
Permanent ponds	*Coleoptera*	*Helochares lividus*	In freshwater ponds		Notable B		
Mires	*Coleoptera*	*Helochares punctatus*	In pools in *Sphagnum* bogs		Notable B		
Temporary ponds	*Coleoptera*	*Helophorus griseus*	In shallow grassy pools		Notable B		
Rivers and streams	*Coleoptera*	*Hydraena nigrita*	In sluggish muddy streams		Notable B		
Rivers and streams	*Coleoptera*	*Hydraena rufipes*	In slow-flowing or stagnant water		Notable B		
Permanent ponds	*Coleoptera*	*Hydrochus angustatus*	In well-vegetated pools		Notable B		
Permanent ponds/temporary ponds	*Coleoptera*	*Hydroglyphus pusillus*	In acidic silt ponds		Notable B		
Mires	*Coleoptera*	*Hydroporus longicornis*	In spring fed bog pools		Notable B		
Mires/rivers and streams	*Coleoptera*	*Laccobius atratus*	Found in wet moss on bogs and in slow-flowing, or stagnant water		Notable B		
Rivers and streams	*Coleoptera*	*Laccobius sinuatus*	In slow-flowing, or stagnant water		Notable B		
Rivers and streams	*Coleoptera*	*Longitarsus parvulus*	Recorded from Avon Water 2000		Notable B		
Dry grassland	*Coleoptera*	*Malachius marginellus*	Grassland		Notable B		
Dry grassland	*Coleoptera*	*Mecinus circulatus*	Associated with *Plantago* spp.		Notable B		
Rivers and streams	*Coleoptera*	*Myllaena elongata*	Beaulieu River		Notable B		
Wet grassland	*Coleoptera*	*Oodes helopioides*	Wet grasslands near standing water		Notable B		
Wet grassland/rivers and streams	*Coleoptera*	*Paederus fucipes*	Margins of ditches and streams		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Mires	*Coleoptera*	*Paracymus scutellaris*	In pools in *Sphagnum* bogs		Notable B		
Permanent ponds	*Coleoptera*	*Pelenomus canaliculatus*	Associated with *Myriophyllum*		Notable B		
Wet grassland	*Coleoptera*	*Philonthus fumaris*	Marshy areas/fens		Notable B		
Rivers and streams	*Coleoptera*	*Phtobius waltni*	Sandy banks adjacent to streams		Notable B		
Permanent ponds	*Coleoptera*	*Phytobius leucogaster*	Associated with *Myriophyllum*		Notable B		
Dry grassland	*Coleoptera*	*Platypalpus articulatus*	In scrubby areas		Notable B		
Mires	*Coleoptera*	*Pselaphaulax dresdensis*	Found in wet moss on bogs		Notable B		
Dry heath	*Coleoptera*	*Pterostichus angustatus*	On sandy or peaty soils on dry heath		Notable B		
Wet grassland	*Coleoptera*	*Pterostichus anthracinus*	Wet grassland		Notable B		
Dry heath	*Coleoptera*	*Pterostichus lepidus*	On dry sandy heathlands		Notable B		
Rivers and streams	*Coleoptera*	*Rhantus grapii*	In well vegetated waterways		Notable B		
Permanent ponds	*Coleoptera*	*Rhantus suturalis*	In heathland pools		Notable B		
Wet heath	*Coleoptera*	*Rhynchaenus iota*	Wet heath in association with *Myrica gale*		Notable B		
Dry grassland	*Coleoptera*	*Sibinia primitus*	Dry grasslands with *Spergularia*		Notable B		
Rivers and streams	*Coleoptera*	*Silis ruficollis*	River margins/lush vegetation		Notable B		
Dry heath	*Coleoptera*	*Sirocalodes mixtus*	Dry heath with trees		Notable B		
Permanent ponds	*Coleoptera*	*Stenolopus teutonus*	Bare ground at edges of ponds		Notable B		
Wet grassland	*Coleoptera*	*Stenus fornicatus*	Along ditch edges		Notable B		
Mires	*Coleoptera*	*Stenus kiesenwetteri*	Boggy pool edges		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Wet grassland	*Coleoptera*	*Stenus nitens*	Found in marshy places		Notable B		
Dry heath	*Coleoptera*	*Agathidium marginatum*	Dry sandy heath		Notable		
Rivers and streams	*Coleoptera*	*Atheta obfuscata*	In flood litter on riverbanks		Notable		
Rivers and streams	*Coleoptera*	*Lathrobium ripicola*	In river shingle and river margins		Notable		
Mires	*Coleoptera*	*Myllaena kraatzi*	In *Sphagnum* moss		Notable		
Dry grassland	*Coleoptera*	*Omalium exiguum*	In well-rotted grass heaps		Notable		
Mires	*Coleoptera*	*Rhopalus maculata*	Bogs		Notable		
Rivers and streams	*Coleoptera*	*Rugilus similis*	Beaulieu River		Notable		
Temporary ponds	Crustaecea	*Triops cancriformis*	Largely unknown		RDB 1	yes	yes
Temporary ponds	Crustaecea	*Chirocephalus diaphanus*	Temporary pools		RBD 2	yes	
Mires	*Diptera*	*Chrysops sepulcharlis*	Heathland pools in bogs		pRDB 1		
Dry heath	*Diptera*	*Chrysotoxum vernale*	Heath/broadleaf woodland edge		RDB 1		
Dry heath	*Diptera*	*Gasterophilus nasalis*	No data available		RDB 1		
Mires/wet heath	*Diptera*	*Syndyas nigripes*	Found in bogs, habitat unknown		RDB 1		
Mires	*Diptera*	*Telmaturgus tumidulus*	Semi-aquatic larvae in mud		RDB 1		
Dry heath	*Diptera*	*Villa circumdata*	Unknown		pRDB 1		
Dry heath	*Diptera*	*Chrysotoxum octomaculatum*	On heathland probably in association with ants		RDB 2	yes	yes
Mires/wet heath	*Diptera*	*Eristalis cryptarum*	Wet heaths and bogs		RDB 2	yes	yes
Mires	*Diptera*	*Nematoproctus*	Habitat unknown, found at Matley Bog in		RDB 2		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
		distendens	1988				
Mires	*Diptera*	*Prionocera pubescens*	*Sphagnum*/*Juncus* bogs		pRDB 2		
Dry heath	*Diptera*	*Callicera aenea*	Heath/broadleaf woodland edge		RDB 3		
Wet heath	*Diptera*	*Campsicnemus pectinulatus*	Recorded from wet peat		RDB 3		
Dry heath	*Diptera*	*Dioctria cothurnata*	Heath/woodland edge		pRDB 3		
Mires	*Diptera*	*Dixella filicornis*	Found in swamps		RDB 3		
Dry heath	*Diptera*	*Eutolmus rufibarbis*	Largely unknown		pRDB 3		
Dry heath	*Diptera*	*Hippobosca equina*	Parasitic on horses		RDB 3		
Wet heath	*Diptera*	*Leucostoma simplex*	Parasitic fly rec. from Latchmore Brook Valley 1971		RDB 3		
Wet heath	*Diptera*	*Microdon mutabilis*	Ants nests on wet heath		RDB 3		
Dry heath	*Diptera*	*Myopa fasciata*	Parasite of adult bees on heathland		pRDB 3		
Mires	*Diptera*	*Ocydromia melanopleura*	In bogs, larvae viviparous, biology unknown		RDB 3		
Rivers and streams	*Diptera*	*Ocydromia melanopleura*	Larvae viviparous, biology unknown		RDB 3		
Mires	*Diptera*	*Orthonovera geniculata*	In boggy areas, larvae probably aquatic		RDB 3		
Wet heath	*Diptera*	*Peleocrocera tricincta*	Wet heaths/bogs woodland edge		RDB 3		
Dry heath	*Diptera*	*Physocephala nigra*	Parasite of the bumblebee *Bombus muscorum*		RDB 3		
Mires	*Diptera*	*Schoenophilus versutus*	Associated with wet flushes with *Juncus* and *Schoenus*		RDB 3		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Wet grassland	*Diptera*	*Tetanocera freyi*	Wetlands, precise habitat unknown		RDB 3		
Dry heath	*Diptera*	*Thyridanthrax fenestratus*	Bare ground, with hosts *Ammophila* spp.		RDB 3	yes	
Mires/wet heath	*Diptera*	*Tipula marginata*	Larvae probably in wet mud/peat		RDB 3		
Dry/wet heath and dry/wet grassland	*Diptera*	*Asilus crabroniformis*	Open areas with herbivore dung		Notable B	yes	yes
Mires	*Diptera*	*Atylotus fulvus*	Wet bog soil, with woodland nearby		Notable B		
Wet heath	*Diptera*	*Campsicnemus pusillus*	Recorded from bogs and wet heaths		Notable B		
Mires	*Diptera*	*Chrysogaster maquarta*	Larvae aquatic, adults on bogs		Notable B		
Rivers and streams	*Diptera*	*Chrysotus kowarzi*	Near rivers and streams		Notable B		
Rivers and streams	*Diptera*	*Chrysotus palustris*	Near rivers and streams		Notable B		
Wet grassland	*Diptera*	*Dictya umbrarum*	Around ponds and marshes larvae aquatic		Notable B		
Mires	*Diptera*	*Erioptera nielseni*	Mildly acid bogs		Notable B		
Dry/wet grassland	*Diptera*	*Gasterophilus intestinalis*	Larvae live in horse intestines		Notable B		
Mires	*Diptera*	*Limnophila abdonimalis*	Exposed peat in bogs		Notable B		
Rivers and streams	*Diptera*	*Nephrotoma dorsalis*	Sandy riverbanks near woodland		Notable B		
Wet grassland	*Diptera*	*Oxycera pygmaea*	Base-rich seepages in wet grassland		Notable B		
Wet grassland	*Diptera*	*Pherbellia nana*	In wetlands preys on snails		Notable B		
Dry heath	*Diptera*	*Platypalpus articulatus*	On scrubby vegetation		Notable B		
Wet grassland/wet heath	*Diptera*	*Scathophaga scybalaria*	Larvae in cattle dung		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Dry heath	*Diptera*	*Sphaerophoria virgata*	Assoc. with heathland, larvae feed on aphids		Notable B		
Rivers and streams	*Diptera*	*Syntormon spicatus*	Found in marshy places, biology unknown		Notable B		
Rivers and streams	*Diptera*	*Syntormon zelleri*	In marshy places		Notable B		
Wet heath	*Diptera*	*Tachytrechus consobrinus*	Found in sandy places near water		Notable B		
Wet grassland	*Diptera*	*Tipula holoptera*	Boggy flushes with *Juncus*		Notable B		
Wet heath	*Diptera*	*Tomosvaryella palliditarsis*	Parasitic on *Homopterans*, found in bogs		Notable B		
Permanent ponds	*Diptera*	*Dictya umbrarum*	Around ponds and marshes, larvae aquatic		Notable B		
Permanent ponds	*Diptera*	*Thrypticus pollinosus*	Larvae stem miners, biology unknown, rec. Hatchet Pond 1988		Notable B		
Mires	*Hemiptera*	*Eysarcoris aeneus*	*Sphagnum* bog		RDB 3		
Mires	*Hemiptera*	*Limotettix atricapillus*	Rec. from Denny Bog 1985		RDB 3		
Permanent ponds/rivers and streams	*Hemiptera*	*Microvelia phymaea*	Among vegetation on still water		RDB 3		
Mires	*Hemiptera*	*Pachybrachius luridus*	*Sphagnum* bog		RDB 3		
Wet grassland	*Hemiptera*	*Macrosteles frontalis*	Found in marshy places		Notable B		
Dry heath	*Hemiptera*	*Megalonotus dilatatus*	Among litter in dry places		Notable B		
Dry heath	*Hymenoptera*	*Cerolapes variegata*	Sandy heathland		RDB 1		
Mires	*Hymenoptera*	*Formica candida*	*Sphagnum*/*Molinia* bogs		RDB 1	yes	yes
Wet heath	*Hymenoptera*	*Homonotus*	A parasite of the spider *Cheiracantheum*		RDB 1	yes	yes

Habitat	Group	Species	Requirements	European	National	BAP	SRP
		sanguinolentus	*erraticum* on largely ungrazed wet heath				
Dry heath	*Hymenoptera*	*Odynerus reniformis*	Bare ground, largely unknown		RDB 1		
Dry heath	*Hymenoptera*	*Nomada signata*	Parasite of *Andrena* bees in open sunny situations		RDB 2		
Dry heath	*Hymenoptera*	*Philanthus triangulum*	Nests in bare ground, adults prey on honeybees		RDB 2		
Dry heath	*Hymenoptera*	*Psen bicolor*	Open sandy heath		pRDB 2		
Dry heath	*Hymenoptera*	*Coelioxys quadridentata*	Unknown		RDB 3		
Dry heath	*Hymenoptera*	*Diodontus insidiosus*	Bare sandy ground on heathland		RDB 3		
Dry heath	*Hymenoptera*	*Halictus confusus*	Disturbed soil in heathland		RDB 3		
Dry heath	*Hymenoptera*	*Hedychridium coriaceum*	Unknown, but a *Sphecid* parasite		RDB 3		
Dry heath	*Hymenoptera*	*Hedychrum nielmelai*	Dry sandy heathland with bare ground		RDB 3		
Dry heath	*Hymenoptera*	*Hylaeus gibbus*	Scrub and dead wood on dry heathland		RDB 3		
Dry heath	*Hymenoptera*	*Lasioglossum pauperatum*	Open ground on sandy heaths		RDB 3		
Dry heath	*Hymenoptera*	*Leptothorax interruptus*	Dry sandy heath with young heather		RDB 3		
Dry heath	*Hymenoptera*	*Nomada fucata*	Parasite of *Andrena* bees in open sunny situations		RDB 3		
Dry heath	*Hymenoptera*	*Nomada fulvicornis*	Parasite of *Andrena* bees in open sunny situations		RDB 3		
Dry heath	*Hymenoptera*	*Nomada hirtipes*	Parasite of *Andrena* bees in open sunny situations		RDB 3		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Dry heath	*Hymenoptera*	*Nomada lathburiana*	Parasite of *Andrena* bees in open sunny situations		RDB 3		
Dry heath	*Hymenoptera*	*Nomada robertjeotiana*	Parasite of *Andrena* bees in open sunny situations		RDB 3		
Dry heath	*Hymenoptera*	*Psen spooneri*	Dry sandy heathland		RDB 3		
Dry heath	*Hymenoptera*	*Sphecodes scabricollis*	Heathy margins of broadleaf woods with bare ground		RDB 3		
Dry heath	*Hymenoptera*	*Stelis ornatula*	Open heath cleptoparasite of *Hoplitis claviventris*		RDB 3		
Dry heath	*Hymenoptera*	*Strongylognathus testaceus*	A parasite of *T. caespitum*		RDB 3		
Dry heath	*Hymenoptera*	*Anergates atratulus*	A parasite of *Tetramorium caespitum*		pRDB K	yes	
Dry heath	*Hymenoptera*	*Crabro scutellatus*	Open heaths possibly with wet areas		Notable A		
Dry grassland	*Hymenoptera*	*Nomada fucata*	Parasite of *Andrena* bees in		Notable A		
Dry heath	*Hymenoptera*	*Oxybelus mandibularis*	Open sandy heathland		Notable A		
Dry heath	*Hymenoptera*	*Sphecodes longulus*	Open bare soils on heaths		Notable A		
Dry heath	*Hymenoptera*	*Sphecodes reticulatus*	Open bare soils on heaths		Notable A		
Dry heath	*Hymenoptera*	*Arachnospilosa minutula*	Open ground on heathland		Notable B		
Dry heath	*Hymenoptera*	*Chesias rufata*	Well-established broom		Notable B		
Dry heath	*Hymenoptera*	*Evagetes dubius*	Open ground on heathland		Notable B		
Dry heath	*Hymenoptera*	*Methocha ichneumonoides*	On dry heathland, parasitic on *Cicindela* larvae		Notable B		
Dry heath	*Hymenoptera*	*Mutilla europaea*	Open sandy heaths with bare ground		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Dry heath	*Hymenoptera*	*Sphecodes crassus*	Open ground and sandy heathland		Notable B		
Dry heath	*Hymenoptera*	*Tiphia minuta*	Larvae parasitic in dung beetles		Notable B		
Dry heath	*Lepidoptera*	*Agrochola haematidea*	Larvae on *Erica cinerea*		pRDB 1		
Dry heath	*Lepidoptera*	*Scythris empetrella*	Larvae in sand pits among vegetation		pRDB 1		
Mires	*Lepidoptera*	*Stenoptilia graphodactyla*	Larvae on *Gentiana pneumonanthes*		pRDB 1		
Mires	*Lepidoptera*	*Coscinia cribraria ssp. bivitta*	Bogs, but ecology unknown		RDB 2	yes	yes
Dry heath	*Lepidoptera*	*Pachythelia villosella*	Mature dry heathland		RDB 2		
Mires/wet heath	*Lepidoptera*	*Buckleria paludum*	Larvae feed on *Drosera* leaves		RDB 3		
Mires/wet heath	*Lepidoptera*	*Crambus silvella*	Larvae on *Carex* spp.		pRDB 3		
Wet heath	*Lepidoptera*	*Heliothis maritima ssp. warneckei*	Humid/wet heaths, larvae on *Erica tetralix*		RDB 3		
Dry heath	*Lepidoptera*	*Lampronia fucsatella*	In galls in *Betula* twigs		RDB 3		
Wet heath	*Lepidoptera*	*Chlorissa viridata*	Damp heathlands, larvae on *Calluna*, *Betula* and *Salix*		Notable A		
Dry heath	*Lepidoptera*	*Chloroclystis chloerata*	In scrubby areas, larvae on *Prunus spinosa* blossom		Notable A		
Dry heath	*Lepidoptera*	*Cleora cinctaria*	Lightly wooded heathland		Notable A		
Wet heath	*Lepidoptera*	*Idaea muricata*	Damp heathlands, larvae on *Potentilla palustris*		Notable A		
Wet grassland	*Lepidoptera*	*Noctua orbona*	Various grasses		Notable A		
Dry heath	*Lepidoptera*	*Pempelia genistella*	Gorse spp.		Notable A		
Dry heath	*Lepidoptera*	*Selidosema brunneraria*	On larger heaths, larvae feed on *Calluna*		Notable A		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Wet heath	*Lepidoptera*	*Sorhagenia janiszewski*	Larvae feed on shoots of frangula		Notable A		
Wet heath	*Lepidoptera*	*Apomyelois bistriatella*	*Daldeinia concentrica* on young or burnt bushes		Notable B		
Permanent ponds/wet grassland	*Lepidoptera*	*Archanara sparganii*	In ponds and ditches, larvae stem feeders in typhus		Notable B		
Dry heath	*Lepidoptera*	*Bembecia scopigera*	Roots of lotus and *Anthyllus*		Notable B		
Rivers and streams	*Lepidoptera*	*Calamotropha paludella*	Larvae in typhus by streams		Notable B		
Permanent ponds	*Lepidoptera*	*Chilodes maritimus*	Reed beds		Notable B		
Dry heath	*Lepidoptera*	*Coleophora vibicella*	Leaves of *Genista tinctoria*		Notable B		
Dry heath	*Lepidoptera*	*Crambus hamella*	Grasses on dry heath		Notable B		
Dry heath	*Lepidoptera*	*Crambus pratella*	Grasses on dry heath		Notable B		
Mires	*Lepidoptera*	*Crambus uliginosellus*	Found in wet bogs, larval biology unknown		Notable B		
Wet grassland	*Lepidoptera*	*Dichrorampha sylvicolana*	Larvae in roots of *Achillea ptarmica*		Notable B		
Dry/wet heath	*Lepidoptera*	*Dyscia fagaria*	On open heathland, larvae on heathers		Notable B		
Wet grassland	*Lepidoptera*	*Euphydryas aurinia* (Possibly introduced to the New Forest)	Larvae on *Succisa pratensis*		Notable B		
Mires	*Lepidoptera*	*Eupocilia ambiguella*	Alder buckthorn berries		Notable B		
Wet heath	*Lepidoptera*	*Eustrotia uncula*	In boggy areas on heaths		Notable B		
Dry heath	*Lepidoptera*	*Evergestis extimalis*	Seed heads of crucifers		Notable B		
Dry heath	*Lepidoptera*	*Hydriomena rubertata*	Open heathland/woodland edge		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Wet heath	*Lepidoptera*	*Hypenodes humidalis*	On boggy heathland		Notable B		
Dry/wet heath	*Lepidoptera*	*Idaea sylvestraria*	On heaths, biology unknown		Notable B		
Dry grassland	*Lepidoptera*	*Microstega hyalinalis*	*Centaura nigra* leaves		Notable B		
Wet heath	*Lepidoptera*	*Monochroa suffusella*	Found in fens/wet heaths, habitat unknown		Notable B		
Dry heath	*Lepidoptera*	*Pachycnemia hipposcatanaria*	Open dry heathland, on *Calluna*		Notable B		
Dry grassland	*Lepidoptera*	*Pediasia contaminella*	Grasses inc. *Festuca ovina*		Notable B		
Dry/wet heath	*Lepidoptera*	*Perconia strigillaria*	On heathland, larvae on herbs		Notable B		
Dry grassland	*Lepidoptera*	*Phalonidia luridana*	Grassy banks with chamomile		Notable B		
Dry heath	*Lepidoptera*	*Plebejus argus*	Dry open heathland		Notable B	yes	
Mires/wet heath	*Lepidoptera*	*Scopula emutaria*	On edges of wet bogs		Notable B		
Mires	*Lepidoptera*	*Simyra albovenosa*	Common reed		Notable B		
Wet heath	*Lepidoptera*	*Sparganothis pilleriana*	Found on damp heaths, larvae on various herbs		Notable B		
Dry heath	*Lepidoptera*	*Synaphe punctalis*	Mosses on sandy habitats		Notable B		
Mires	*Lepidoptera*	*Xylena vetusta*	In bogs/marshy places		Notable B		
Temporary ponds	*Mollusca*	*Lymnaea glabra*	Temp pools and ditches		RDB 3		
Mires/wet heath/rivers and streams	*Odonata*	*Coenagrion mercuriale*	Wet heaths/seepages/streams	Annex II HD	RDB 2	yes	yes
Mires/wet heath	*Odonata*	*Ceriagrion tenellum*	Wet heaths/seepages/streams		Notable B		
Mires/wet heath	*Odonata*	*Coenagrion pulchellum*	Wet heaths/seepages/streams		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Permanent ponds/rivers and streams	*Odonata*	*Cordulia aenea*	Permanent water source		Notable B		
Mires/wet heath	*Odonata*	*Ischnura pumilio*	Wet heaths/seepages/streams		Notable B		
Rivers and streams/wet grassland	*Orthoptera*	*Gryllotalpa gryllotalpa*	Damp grassland on stream edges		RDB 1	yes	yes
Mires	*Orthoptera*	*Stethophyma grossum*	*Sphagnum*/*Molinia* bogs		RDB 2	yes	yes
Dry heath	*Orthoptera*	*Chorthippus vagans*	Bare ground and *Calluna*		RDB 3	yes	yes
Wet grassland/wet heath	*Orthoptera*	*Conocephalus discolor*	Coarse vegetation in wetlands		Notable A		
Wet grassland/wet heath	*Orthoptera*	*Tetrix ceperoi*	Wet seepages with bare ground		Notable A		
Dry heath	*Orthoptera*	*Ectobius pallidus*	Scrubby heathland with deep litter		Notable B		
Dry heath	*Orthoptera*	*Ectobius panzeri*	Open sunny heathland with bare ground		Notable B		
Mires/wet heath	*Orthoptera*	*Metrioptera brachyoptera*	*Sphagnum*/*Molinia* bogs and wet heath		Notable B		
Wood pasture	*Coleoptera*	*Eucnemis capucina*	Rotten wood under bark		RDB 1	yes	
Wood pasture	*Coleoptera*	*Megapenthes lugens*	In decaying beech and elm		RDB 1	yes	
Wood pasture	*Coleoptera*	*Melandrya barbata*	In decaying oak and beech		RDB 1		
Wood pasture	*Coleoptera*	*Silvanoprus fagi*	Under beech and pine bark		RDB 1		
Wood pasture	*Coleoptera*	*Velleius dilatatus*	Larvae in hornet's nests in old trees		RDB 1		
Wood pasture	*Coleoptera*	*Gnorimus nobilis*	In wood mould of deciduous trees		RDB 2	yes	
Forestry Inclosures	*Coleoptera*	*Lymexylon navale*	Standing dead wood		RDB 2		
Bog woodland	*Coleoptera*	*Ampedus*	Larvae in rotten wood		RDB 3		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
		cinnabarinus					
Wood pasture	*Coleoptera*	*Anthonomus rufus*	Larvae mainly in blackthorn, usually coastal		RDB 3		
Wood pasture	*Coleoptera*	*Colydium elongatum*	In burrows of wood boring beetles in ancient woodland		RDB 3		
Wood pasture	*Coleoptera*	*Dirrhagus pygmaeus*	Dead hardwood		RDB 3		
Wood pasture	*Coleoptera*	*Grammoptera ustulata*	Larvae probably in dead wood		RDB 3		
Wood pasture	*Coleoptera*	*Ischnomera caerula*	Dead wood usually oak		RDB 3		
Wood pasture	*Coleoptera*	*Leptura sexguttata*	Larvae in dead oak		RDB 3		
Wood pasture	*Coleoptera*	*Malachius aeneus*	Larvae probably in dead wood		RDB 3	SAP	
Wood pasture	*Coleoptera*	*Mesosa nebulosa*	Larvae in topmost branches of oak		RDB 3		
Wood pasture	*Coleoptera*	*Plegaderus dissectus*	In decaying stumps, logs and trees		RDB 3		
Bog woodland	*Coleoptera*	*Selatosomus nigricornis*	Larvae in waterlogged soil in wet woodland		RDB 3		
Wood pasture	*Coleoptera*	*Triplax lacordairii*	Probably in fungi on trees, unknown		RDB 3		
Forestry Inclosures	*Coleoptera*	*Eutheia plicata*	Open areas		RDB K		
Wood pasture	*Coleoptera*	*Gyrophaena pulchella*	Recorded from the fungus *Hypoloma fasciculare*		RDB K		
Wood pasture	*Coleoptera*	*Mordella holomelaena*	In dead wood or plant stems		RDB K		
Wood pasture	*Coleoptera*	*Sphinginus lobatus*	Dead twigs		RDB K		
Wood pasture	*Coleoptera*	*Zyras cognatus*	Recorded from *Lasius niger* nests in woodland		RDB K		
Wood pasture	*Coleoptera*	*Agrilus sinuatus*	Associated with very old hawthorn bushes		Notable A		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Wood pasture	*Coleoptera*	*Ampedus elongantulus*	Larvae in rotting stumps		Notable A		
Wood pasture	*Coleoptera*	*Ampedus sanguinolentus*	Larvae in dead wood/stumps		Notable A		
Wood pasture	*Coleoptera*	*Anisoxya fuscula*	In dead twigs		Notable A		
Bog woodland	*Coleoptera*	*Atheta cribrata*	In mosses and leaf-litter		Notable A		
Wood pasture	*Coleoptera*	*Calosoma inquisitor*	On oak trees		Notable A		
Forestry Inclosures	*Coleoptera*	*Cicindela sylvatica*	Heathy areas in conifer woods		Notable A	yes	
Wood pasture	*Coleoptera*	*Cicones variegatus*	On dry, decayed bark of beech		Notable A		
Forestry Inclosures	*Coleoptera*	*Coccinella magnifica*	Open areas, in association with *Formica rufa*		Notable A		
Wood pasture	*Coleoptera*	*Dasytes niger*	Larvae probably in dead wood		Notable A		
Wood pasture	*Coleoptera*	*Geotrupes pyranaeus*	Dead wood		Notable A		
Wood pasture	*Coleoptera*	*Ischnodes sanguinicollis*	On broadleaves in decaying wood		Notable A		
Wood pasture	*Coleoptera*	*Leptura scutellata*	In rotting wood, mainly beech		Notable A		
Wood pasture	*Coleoptera*	*Mycetochara humeralis*	In dead wood and under bark		Notable A		
Wood pasture/forestry Inclosures	*Coleoptera*	*Mycetophagus quadriguttatus*	On dung or bracket fungi		Notable A		
Wood pasture	*Coleoptera*	*Notolaemus unifasciatus*	Larvae under bark of dead beech		Notable A		
Wood pasture	*Coleoptera*	*Pediacus depressus*	Larvae under oak bark on sap runs		Notable A		
Wood pasture	*Coleoptera*	*Pilemostoma fastosa*	Dead wood		Notable A		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Wood pasture	*Coleoptera*	*Prionus coriarius*	Tree roots		Notable A		
Riverine woodland	*Coleoptera*	*Quedius plancus*	In riverine gravels/woodland		Notable A		
Wood pasture	*Coleoptera*	*Strangalia aurulenta*	Probably in dead deciduous trees		Notable A		
Wood pasture	*Coleoptera*	*Strangalia nigra*	Probably in dead deciduous trees		Notable A		
Wood pasture	*Coleoptera*	*Tomoxia biguttata*	Beech trunk		Notable A		
Wood pasture	*Coleoptera*	*Tomoxia bucephala*	In rotting beech stumps		Notable A		
Wood pasture	*Coleoptera*	*Abdera biflexuosa*	In dead wood and twigs		Notable B		
Wood pasture	*Coleoptera*	*Aderus oculatus*	Oak stumps and boughs/oak crowns		Notable B		
Bog woodland	*Coleoptera*	*Agonum livens*	Alder/willow carr, wet woods		Notable B		
Wood pasture	*Coleoptera*	*Agrilus laticornis*	In dying branches of oak		Notable B		
Bog woodland/Wood pasture	*Coleoptera*	*Ampedus pomorum*	Larvae in decayed wood/stumps		Notable B		
Wood pasture	*Coleoptera*	*Ampedus quercicola*	Larvae in dead wood		Notable B		
Wood pasture/forestry Inclosures	*Coleoptera*	*Anaglyptus mysticus*	In tree stumps		Notable B		
Wood pasture	*Coleoptera*	*Antherophagus canascens*	Fungus beetle		Notable B		
Wood pasture	*Coleoptera*	*Aphodius zenkeri*	In deer dung in woodland		Notable B		
Wood pasture	*Coleoptera*	*Aplocnemus pini*	Under bark in decayed wood		Notable B		
Bog woodland	*Coleoptera*	*Aromia moschata*	Larvae bore into mature trees		Notable B		
Bog woodland	*Coleoptera*	*Atheta hygrobia*	In mosses and leaf-litter		Notable B		
Wood pasture	*Coleoptera*	*Atomaria fimetarii*	Rotting wood		Notable B		
Forestry Inclosures	*Coleoptera*	*Ceuthorhynchus viduatus*	Roydon		Notable B		
Forestry Inclosures	*Coleoptera*	*Cionus tuberculosus*	Roydon		Notable B		
Wood pasture	*Coleoptera*	*Cis festivus*	Rotting wood		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Wood pasture	*Coleoptera*	*Cis lineatocribratus*	In the fungus *Polyporus nigrinus* on trees		Notable B		
Wood pasture	*Coleoptera*	*Conopalpus testaceus*	In dead boughs and small branches		Notable B		
Wood pasture	*Coleoptera*	*Cryptarcha strigata*	On sap runs caused by *Cossus*		Notable B		
Wood pasture	*Coleoptera*	*Cryptarcha undata*	On sap runs caused by *Cossus*		Notable B		
Wood pasture/forestry Inclosures	*Coleoptera*	*Cryptocephalus bipunctatus*	Larvae free-living on foliage		Notable B		
Wood pasture/ forestry Inclosures	*Coleoptera*	*Cryptocephalus parvulus*	Larvae on birch leaves		Notable B		
Wood pasture	*Coleoptera*	*Ctesias serra*	Larvae under loose bark of broadleaves		Notable B		
Wood pasture	*Coleoptera*	*Dendroxena quadrimaculata*	Oak canopy		Notable B		
Wood pasture	*Coleoptera*	*Diplocoelus fagi*	Under bark in decayed wood		Notable B		
Wood pasture	*Coleoptera*	*Eledona agricola*	On the bracket fungus *Laetiporus sulphureus* on oak		Notable B		
Wood pasture	*Coleoptera*	*Epuraea fuscicollis*	On sap runs caused by *Cossus*		Notable B		
Wood pasture	*Coleoptera*	*Epuraea guttata*	On sap runs caused by *Cossus*		Notable B		
Wood pasture	*Coleoptera*	*Euplectus kirbyi*	Under bark and in dead wood		Notable B		
Wood pasture	*Coleoptera*	*Gabrius velox*	Wet woodland		Notable B		
Wood pasture	*Coleoptera*	*Hallomenus binotatus*	In fungus infected wood and in fungi on wood		Notable B		
Wood pasture	*Coleoptera*	*Helops caeruleus*	In dead/dying trees usually oak		Notable B		
Wood pasture	*Coleoptera*	*Ischnomera cyanea*	In rotten wood of broadleaves		Notable B		
Wood pasture	*Coleoptera*	*Ischnomera sanguinicollis*	In dead/rotting wood		Notable B		
Wood pasture	*Coleoptera*	*Korynetes caeruleus*	Predatory on beetle larvae in dead wood		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Forestry Inclosures	*Coleoptera*	*Larinus planus*	Thistles		Notable B		
Wood pasture	*Coleoptera*	*Lissodema quadripustulata*	In dead and decaying trees		Notable B		
Forestry Inclosures	*Coleoptera*	*Longitarsus obliteratus*	Roydon deadwood		Notable B		
Forestry Inclosures	*Coleoptera*	*Longitarsus ochroleucus*	Roydon deadwood		Notable B		
Forestry Inclosures	*Coleoptera*	*Longitarsus tabidus*	Roydon deadwood		Notable B		
Wood pasture	*Coleoptera*	*Lucanus cervus*	Rotting timber/mature trees	Annex II HD	Notable B	yes	yes
Wood pasture	*Coleoptera*	*Luperus flavipes*	Associated with broadleaves, grass root feeders		Notable B		
Wood pasture	*Coleoptera*	*Magdalis cerasi*	Associated with broadleaves, larvae feed in twigs		Notable B		
Wood pasture	*Coleoptera*	*Malachius cyanea*	Rotting wood		Notable B		
Wood pasture	*Coleoptera*	*Malthodes fibulatus*	In dead twigs and branches		Notable B		
Riverine woodland	*Coleoptera*	*Melandrya caraboides*	In rotting stumps, possibly willow		Notable B		
Wood pasture	*Coleoptera*	*Melasis buprestoides*	Larvae in standing dead wood		Notable B		
Wood pasture	*Coleoptera*	*Mycetophagus piceus*	In rotting heartwood of oaks		Notable B		
Wood pasture	*Coleoptera*	*Mycetophagus populi*	Fungus on beech stump		Notable B		
Forestry Inclosures	*Coleoptera*	*Onthophagus vacca*	On fox dung in Roydon Wood (2000)		Notable B		
Wood pasture	*Coleoptera*	*Opilo mollis*	Predatory on beetle larvae in dead wood		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Wood pasture	*Coleoptera*	*Phloiotrya vaudoueri*	In dead sap wood, usually oak		Notable B		
Forestry Inclosures	*Coleoptera*	*Phytobius waltonii*	Deadwood		Notable B		
Wood pasture	*Coleoptera*	*Polydrusus flavipes*	Old woodland, dead wood		Notable B		
Wood pasture	*Coleoptera*	*Prionocyphon serricornis*	In rot holes feeding on fly larvae		Notable B		
Wood pasture	*Coleoptera*	*Prionychus ater*	In dead/dying broadleaves		Notable B		
Wood pasture	*Coleoptera*	*Pseudocistella ceramboides*	Decaying beech		Notable B		
Wood pasture	*Coleoptera*	*Ptinus subpilosus*	In hollow trees and under bark usually on oak		Notable B		
Wood pasture	*Coleoptera*	*Pyrochroa coccinea*	In dead wood and under bark		Notable B		
Wood pasture	*Coleoptera*	*Quedius scitus*	Under bark and in dead wood		Notable B		
Wood pasture	*Coleoptera*	*Rabocerus gabrieli*	In dead wood and under bark		Notable B		
Wood pasture	*Coleoptera*	*Selatosomus bipustulatus*	Larvae in dead wood		Notable B		
Forestry Inclosures	*Coleoptera*	*Sibinia arenaria*	Roydon		Notable B		
Wood pasture	*Coleoptera*	*Silvanus bidentatus*	Under bark of trees		Notable B		
Wood pasture	*Coleoptera*	*Snychita humeralis*	Under fungus infected bark		Notable B		
Wood pasture	*Coleoptera*	*Sphindus dubius*	On slime moulds on bark		Notable B		
Wood pasture	*Coleoptera*	*Sulacis bicornis*	Bracket fungus, beech		Notable B		
Wood pasture	*Coleoptera*	*Thymalus limbatus*	Under bark of broad-leaved trees		Notable B		
Wood pasture	*Coleoptera*	*Tillus elongatus*	Predatory on beetle larvae in dead wood		Notable B		
Wood pasture	*Coleoptera*	*Trachyphloeus aristatus*	Leaf litter		Notable B		
Bog woodland	*Coleoptera*	*Trichophya pilicornis*	Sawdust, wood mould in bog woodland		Notable B		
Wood pasture/forestry	*Coleoptera*	*Xyleborus dispar*	Larvae tunnel feeders in broadleaves		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Inclosures							
Wood pasture/forestry Inclosures	*Coleoptera*	*Xyleborus dryographus*	Larvae tunnel feeders in broadleaves		Notable B		
Riverine woodland	*Coleoptera*	*Atheta cribrata*	In mosses and leaf-litter		Notable		
Riverine woodland	*Coleoptera*	*Atheta hygrobia*	In mosses and leaf-litter		Notable		
Wood pasture	*Coleoptera*	*Dropephylla gracilicornis*	Under bark and in rotten oak		Notable		
Wood pasture	*Coleoptera*	*Gyrophaena angustata*	Dead wood		Notable		
Wood pasture	*Coleoptera*	*Gyrophaena congrua*	Dead wood		Notable		
Wood pasture	*Coleoptera*	*Gyrophaena hanseni*	In *Russula* and *Boletus* fungi		Notable		
Wood pasture	*Coleoptera*	*Neuraphes plicicollis*	In dead wood and under bark		Notable		
Wood pasture	*Coleoptera*	*Placusa depressa*	In burrows of bark beetles		Notable		
Wood pasture	*Coleoptera*	*Sepedophilus testaceus*	In rotting/fungoid wood especially beech and *Salix*		Notable		
Wood pasture	*Coleoptera*	*Thamiaraea hospita*	On sap runs of oak and those of *Cossus*		Notable		
Wood pasture	*Diptera*	*Caliprobola speciosa*	Rotting stumps in woodland		RDB 1		
Wood pasture	*Diptera*	*Brachpeza armata*	In fungus on trees		RDB 2		
Wood pasture	*Diptera*	*Ctenophora flaveolata*	Larvae in dead trees especially beech		RDB 2		
Wood pasture	*Diptera*	*Dirhagus pygmaeus*	Larvae in rotten wood		RDB 2		
Wood pasture	*Diptera*	*Exorista glossatorum*	Parasitic fly, larvae in *Lepidoptera*		RDB 2		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Wood pasture	*Diptera*	*Limonia quadrimaculata*	Larvae in bracket fungi on beech		RDB 2		
Wood pasture	*Diptera*	*Lymexylon navale*	Standing dead wood		RDB 2		
Wood pasture	*Diptera*	*Microdon devius*	Larvae in ant nests in rotten wood		RDB 2		
Wood pasture	*Diptera*	*Pocota personata*	Rot holes in trees		RDB 2		
Wood pasture	*Diptera*	*Psilota anthacina*	In woodland biology unknown		RDB 2		
Wood pasture	*Diptera*	*Brachyopa bicolor*	Rotten beech trees		RDB 3		
Wood pasture	*Diptera*	*Brachypalpus laphriformis*	Standing hollow trunks, especially beech and ash		RDB 3		
Wood pasture	*Diptera*	*Callicera aenea*	Possibly dead wood on heathland edge		RDB 3		
Bog woodland	*Diptera*	*Dixella filicornis*	In swamps/bog woodland larvae stem feeders		RDB 3		
Bog woodland/riverine woodland	*Diptera*	*Dolichopus andalusiacus*	Larvae develop in mud		RDB 3		
Wood pasture	*Diptera*	*Oedalea apicalis*	In decaying trees, in association with *Cossus*		RDB 3		
Riverine woodland	*Diptera*	*Peleocrocera tricincta*	Larvae possibly in mud		RDB 3		
Wood pasture	*Diptera*	*Systenus pallipes*	Probably associated with elm, dead wood feeders, adults at sap runs		RDB 3		
Bog woodland	*Diptera*	*Tabanus miki*	Wet woodlands		RDB 3		
Bog woodland	*Diptera*	*Tipula marginata*	Largely unknown		RDB 3		
Riverine woodland	*Diptera*	*Tabanus bovinus*	Wet woodlands		pRDB K		
Riverine woodland	*Diptera*	*Tabanus miki*	Wet woodlands		pRDB K		
Riverine woodland	*Diptera*	*Atylotus fulvus*	Wet boggy soil near woodland		Notable B		
Wood pasture	*Diptera*	*Conops vesicularis*	In old broad-leaved woodland, parasitoid		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
			on *Hymenoptera*				
Wood pasture	*Diptera*	*Ctenophora pectinicornis*	Larvae develop in decaying wood of old trees		Notable B		
Wood pasture	*Diptera*	*Ditomyia fasciata*	In bracket fungus on old trees		Notable B		
Wood pasture	*Diptera*	*Dryodromia testacea*	Habitat requirements unknown		Notable B		
Bog woodland	*Diptera*	*Limnophila pulchella*	Boggy ground in woodland with *Sphagnum*		Notable B		
Wood pasture	*Diptera*	*Metasyrphus nitens*	Ancient deciduous woodland		Notable B		
Riverine woodland	*Diptera*	*Nephrotoma dorsalis*	Sandy riverbanks by woodland		Notable B		
Wood pasture	*Diptera*	*Ogcodes gibbosus*	Heathy areas in woodland		Notable B		
Riverine woodland	*Diptera*	*Tetanocera punctifrons*	In woodland with running water		Notable B		
Wood pasture	*Diptera*	*Brachyopa pilosa*	Rotten stumps especially beech		Notable		
Wood pasture	*Diptera*	*Criorhina ranunculi*	Standing dead wood		Notable		
Wood pasture	*Diptera*	*Didea fasciata*	Broad-leaved woodland		Notable		
Pasture woodland/forestry Inclosures	*Diptera*	*Dioctria oelandica*	Oak woods with small trees present		Notable		
Wood pasture	*Diptera*	*Ferdinandea ruficornis*	Old standing wood possibly associated with *Cossus*		Notable		
Wood pasture	*Diptera*	*Laphria marginata*	Ancient oak forests		Notable		
Wood pasture	*Diptera*	*Metasyrphus latilunulatus*	Woods and heathland edge		Notable		
Wood pasture	*Diptera*	*Microdon eggeri*	Larvae in ant nests in rotten wood		Notable		
Wood pasture	*Diptera*	*Microdon mutabilis*	Larvae in ant nests in rotten wood		Notable		
Wood pasture	*Diptera*	*Myolepta luteola*	Rot holes in broadleaf trees		Notable		
Riverine	*Diptera*	*Platycheirus*	Damp woodland		Notable		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
woodland/wood pasture		*sticticus*					
Bog woodland/riverine woodland	*Diptera*	*Tabanus cordiger*	Wet broadleaf woodland with streams		Notable		
Wood pasture	*Diptera*	*Volucella inflata*	Sap runs on trees, associated with *Cossus*		Notable		
Riverine woodland/wood pasture	*Diptera*	*Xylota abiens*	Dead wood in damp woodland		Notable		
Riverine woodland/wood pasture	*Diptera*	*Xylota florum*	Dead wood in damp woodland		Notable		
Riverine woodland/wood pasture	*Diptera*	*Xylota tarda*	Dead wood in damp woodland		Notable		
Wood pasture	*Diptera*	*Xylota xanthocnema*	Dead wood		Notable		
Wood pasture/forestry Inclosures	*Hemiptera*	*Cicadetta montana*	Dry sunny glades/woodland edge		RDB 1	yes	yes
Wood pasture	*Hemiptera*	*Empicoris baerensprungi*	On trunks and branches of broadleaves		RDB 3		
Wood pasture	*Hemiptera*	*Sehirus biguttatus*	A ground-dweller on *Melampyrum pratense*		Notable B		
Wood pasture	*Hymenoptera*	*Crossocerus vagabundus*	Dead wood in sunny glades and damp woods		RDB 1		
Wood pasture/forestry Inclosures	*Hymenoptera*	*Omalus puncticollis*	Wooded habitats, probably requires dead wood		Notable A		
Wood pasture	*Hymenoptera*	*Crossocerus binotus*	Associated with dead wood in woodlands		Notable B		
Forestry Inclosures	*Lepidoptera*	*Acosmetia*	Woodland glades with *Serratula*		RDB 1	yes	yes

Habitat	Group	Species	Requirements	European	National	BAP	SRP
		caliginosa					
Wood pasture	*Lepidoptera*	*Acrolepiosis marcidella*	Butcher's broom		RDB1		
Wood pasture	*Lepidoptera*	*Aplota palpella*	Mosses on trunks		RDB1		
Forestry Inclosures	*Lepidoptera*	*Archips oporana*	Conifer needles		RDB1		
Wood pasture	*Lepidoptera*	*Argynnis cydippe*	Violets under bracken in sunlight		RDB2		
Wood pasture	*Lepidoptera*	*Catocala sponsa*	Larvae feed on oak		RDB2	yes	
Wood pasture	*Lepidoptera*	*Biselachista trapeziella*	*Luzula* leaves		RDB 3		
Riverine woodland	*Lepidoptera*	*Caloptilia falconipennella*	Larvae on *Alnus*		RDB 3		
Wood pasture	*Lepidoptera*	*Catocala promissa*	Larvae feed on oak		RDB 3	yes	
Bog woodland	*Lepidoptera*	*Cyclophora pendularia*	Sallow carr in wet woods		RDB 3	yes	
Wood pasture	*Lepidoptera*	*Eupithecia egenaria*	Larvae feed on lime		RDB 3		
Wood pasture	*Lepidoptera*	*Heterogenea asella*	Larvae on oak and beech		RDB 3		
Wood pasture	*Lepidoptera*	*Moma alpium*	Larvae feed on oak		RDB 3	yes	
Wood pasture	*Lepidoptera*	*Stigmella samiatella*	Leaf miner on oak		RDB 3		
Forestry Inclosures	*Lepidoptera*	*Aleucis distinctata*	In blackthorn thickets/scrub		Notable A		
Wood pasture	*Lepidoptera*	*Chloroclystis debiliata*	In woodland, larvae on *Vaccinium myrtillus*		Notable A		
Wood pasture	*Lepidoptera*	*Ectodemia artifrontella*	Oak bark		Notable A		
Wood pasture	*Lepidoptera*	*Eupithecia irriguata*	Mature woodland, larvae on oak		Notable A		
Wood pasture/forestry Inclosures	*Lepidoptera*	*Hemaris fuciformis*	Woodland rides/glades, larvae on *Lonicera*		Notable A		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Bog woodland/riverine woodland	*Lepidoptera*	*Lampropteryx otregiata*	Damp woodland, larvae on *Gallium palustre*		Notable A		
Wood pasture	*Lepidoptera*	*Meganola strigula*	Mature oak woodland, larvae possibly on oak		Notable A		
Wood pasture	*Lepidoptera*	*Pechipogo strigilata*	Old woodland		Notable A		
Wood pasture/forestry Inclosures	*Lepidoptera*	*Anania verbascalis*	Larvae on *Teucrium*		Notable B		
Riverine woodland	*Lepidoptera*	*Anticollix sparsata*	Yellow loosestrife riverbank		Notable B		
Wood pasture/forestry Inclosures	*Lepidoptera*	*Apatura iris*	Oak and sallow in mature woodland		Notable B	yes	
Wood pasture	*Lepidoptera*	*Apoda limacodes*	In mature beech/oak woodland		Notable B		
Bog woodland	*Lepidoptera*	*Apotomis lineana*	Sallow leaves in boggy ground		Notable B		
Riverine woodland	*Lepidoptera*	*Archiearis notha*	Tall aspen		Notable B		
Wood pasture	*Lepidoptera*	*Atolmis rubricollis*	Lichens and algae on tree branches		Notable B		
Forestry Inclosures	*Lepidoptera*	*Batrachedra pinicolella*	Larvae feed on *Pinus* needles		Notable B		
Wood pasture	*Lepidoptera*	*Biselachista serricornis*	*Carex* leaves		Notable B		
Wood pasture	*Lepidoptera*	*Boarmia roboraria*	In old oak woodland, larvae on oak		Notable B		
Wood pasture/forestry Inclosures	*Lepidoptera*	*Boloria euphrosyne*	Open woodland rides with violet		Notable B	yes	yes
Wood pasture/forestry Inclosures	*Lepidoptera*	*Capperia britanniodactyla*	Larvae feed in stems of *Teucrium*		Notable B		
Wood pasture	*Lepidoptera*	*Catarhoe rubidata*	Bedstraws in bushes		Notable B		
Wood pasture	*Lepidoptera*	*Cepphis advernaria*	Open woodland larvae on vaccinium		Notable B		
Forestry Inclosures	*Lepidoptera*	*Clavigesta*	Pine buds, flowers		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
		sylvestrana					
Wood pasture	*Lepidoptera*	*Clostera curtula*	Aspen and sallow leaves		Notable B		
Wood pasture/forestry Inclosures	*Lepidoptera*	*Clostera pigra*	In woodland, larvae on *Populus tremula* and *Salix*		Notable B		
Riverine woodland	*Lepidoptera*	*Coleophora ahenella*	Buckthorn/alder buckthorn leaves		Notable B		
Wood pasture	*Lepidoptera*	*Conistra rubiginea*	Deciduous trees		Notable B		
Wood pasture/forestry Inclosures	*Lepidoptera*	*Cossus*	Standing dead wood		Notable B		
Riverine woodland	*Lepidoptera*	*Cyclophora annulata*	Maple		Notable B		
Forestry Inclosures	*Lepidoptera*	*Cydia coniferana*	Larvae on *Pinus* needles		Notable B		
Wood pasture	*Lepidoptera*	*Dicallomera fascelina*	In woodland, larvae on various shrubs		Notable B		
Wood pasture	*Lepidoptera*	*Drepana cultraria*	Inhabits beech woods, larvae on *Fagus*		Notable B		
Wood pasture	*Lepidoptera*	*Dystebenna stephensi*	Living bark of old trees		Notable B		
Riverine woodland	*Lepidoptera*	*Earias clorana*	Sallows and willows in wet woods		Notable B		
Wood pasture	*Lepidoptera*	*Ectropis consonaria*	In open woodland, larvae on oak and birch		Notable B		
Wood pasture	*Lepidoptera*	*Ectropis extersaria*	In open woodland, larvae on oak and birch		Notable B		
Wood pasture	*Lepidoptera*	*Eilema sororcula*	In woodland, larvae feed on various lichens		Notable B		
Wood pasture	*Lepidoptera*	*Elaphria venustula*	Tormentil under bracken woodland		Notable B		
Bog woodland	*Lepidoptera*	*Epinotia demarniana*	Catkins of birch, sallow or alder		Notable B		
Wood pasture	*Lepidoptera*	*Eucosmomorpha albersana*	Honeysuckle leaves		Notable B		
Wood pasture	*Lepidoptera*	*Eudemis porphyrana*	Crab apple leaves		Notable B		
Wood pasture	*Lepidoptera*	*Eudonia delunella*	Larvae feed on lichens on mature trees		Notable B		
Wood pasture	*Lepidoptera*	*Euphydryas aurinia*	Violets under bracken in sunlight		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Wood pasture	*Lepidoptera*	*Euphyia biangulata*	Woodland edge, larvae on *Stellaria*		Notable B		
Wood pasture	*Lepidoptera*	*Eupitheca insigniata*	Hawthorn leaves		Notable B		
Wood pasture	*Lepidoptera*	*Eupithecia dodoneata*	Open woodland, larvae on *Cratageus*		Notable B		
Wood pasture	*Lepidoptera*	*Eupithecia exiguata*	Hawthorn and blackthorn leaves		Notable B		
Forestry Inclosures	*Lepidoptera*	*Eupithecia indigata*	Inhabits *Pinus* woodland		Notable B		
Wood pasture	*Lepidoptera*	*Eupithecia inturbata*	Woodland with *Acer campestre*		Notable B		
Wood pasture	*Lepidoptera*	*Eupithecia plumbeolata*	Woodland with foodplant *Melampyrum pratense*		Notable B		
Wood pasture/forestry Inclosures	*Lepidoptera*	*Eupithecia valerianata*	Damp woods with valerian		Notable B		
Wood pasture/forestry Inclosures	*Lepidoptera*	*Hamearis lucina*	Open woodland rides with primrose		Notable B	yes	
Wood pasture	*Lepidoptera*	*Hypena crassalis*	In woodland, larvae on *Vaccinium*		Notable B		
Bog woodland/riverine woodland	*Lepidoptera*	*Ipimorpha retusa*	Damp woodland, larvae on *Salix*		Notable B		
Forestry Inclosures	*Lepidoptera*	*Lacanobia contigua*	In woodland, larvae on various trees		Notable B		
Wood pasture	*Lepidoptera*	*Meganola albula*	Leaves on *Rubus caesius*		Notable B		
Wood pasture	*Lepidoptera*	*Metriotes lutarea*	Seeds of greater stitchwort woodland		Notable B		
Wood pasture	*Lepidoptera*	*Microthrix similella*	Larvae feed in the crowns of mature oak		Notable B		
Forestry Inclosures	*Lepidoptera*	*Mompha langiella*	Larvae on enchanter's nightshade		Notable B		
Forestry Inclosures	*Lepidoptera*	*Mompha terminella*	Larvae on enchanter's nightshade		Notable B		
Wood pasture	*Lepidoptera*	*Nemapogon ruricolella*	Bracket fungi		Notable B		
Wood pasture	*Lepidoptera*	*Noctua comes*	Grass leaves		Notable B		
Wood pasture	*Lepidoptera*	*Olethreutes arcella*	Decaying leaves		NotableB		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Wood pasture	*Lepidoptera*	*Pammene albuginana*	Oak galls		Notable B		
Wood pasture	*Lepidoptera*	*Pammene fasciana*	Fruits of oak or sweet chestnut		Notable B		
Wood pasture	*Lepidoptera*	*Pammene germmana*	Unknown		Notable B		
Wood pasture	*Lepidoptera*	*Parascotia fuliginaria*	Fungi on dead wood		Notable B		
Wood pasture	*Lepidoptera*	*Psoricoptera gibbosella*	Larvae feed on oak		Notable B		
Wood pasture	*Lepidoptera*	*Satyrium w-album*	Elm and wych elm		Notable B		
Wood pasture	*Lepidoptera*	*Schrankia taenialis*	Damp woodland		Notable B		
Wood pasture	*Lepidoptera*	*Scoparia ancipitella*	Lichens on oak and elm possibly		Notable B		
Wood pasture	*Lepidoptera*	*Strophedra nitidana*	Oak leaves		Notable B		
Wood pasture	*Lepidoptera*	*Synanthedon vespiformis*	Oak borer		Notable B		
Wood pasture/forestry Inclosures	*Lepidoptera*	*Tethea or*	Found on aspen		Notable B		
Riverine woodland	*Lepidoptera*	*Xylena vetusta*	In wet woodland/marshy places		Notable B		
Wood pasture	*Lepidoptera*	*Yponnomeuta vigintipunctata*	Larvae feed on leaves of *Sedum telephum*		Notable B		
Forestry Inclosures	*Lepidoptera*	*Zeiraphera rufimitrana*	Shoots of conifers		Notable B		
Wood pasture/forestry Inclosures	*Orthoptera*	*Nemobius sylvestris*	Warm sunny rides/glades with leaf litter		Notable A		
Wood pasture/forestry	*Orthoptera*	*Ectobius lapponicus*	Open sunny warm well-vegetated clearings		Notable B		

Habitat	Group	Species	Requirements	European	National	BAP	SRP
Inclosures			and rides				
Forestry Inclosures	*Orthoptera*	*Ectobius pallidus*	Scrubby heathland with deep litter		Notable B		
Wood pasture/forestry Inclosures	*Orthoptera*	*Omocestus rufipes*	Open warm sunny well-vegetated clearings and rides		Notable B		

Lepidoptera: butterflies and moths

Butterflies

Of 57 resident species of butterfly present in the UK, 33 have been recorded in the New Forest since 1970. However, while some species are maintaining their populations, the woodland species in particular have experienced significant declines in recent decades (Tubbs (1986), Oates (1996), Green (2000)). Of 17 species of conservation concern recorded in the New Forest since 1980, one is now extinct (high brown fritillary *Argynnis adippe),* another is virtually extinct (Duke of Burgundy *Hamearis lucina*, now only recorded from Langley Wood) and two are failed reintroductions at Roydon Wood (marsh fritillary *Eurodryas aurinia* and heath fritillary *Mellicta athalia*). Of the remainder listed on Table 22 most of the woodland species are struggling. Only the heathland species silver-studded blue *Plebejus argus* and grayling *Hipparchia semele* are common and widespread over suitable habitat.

The likely reasons for this continuing decline in butterflies are outlined below, but the ongoing changes in Inclosure woodland management through the New Forest Forest Plan may lead to significant recovery of key species. Those which could potentially benefit in the coming years are white admiral *Ladoga camilla,* purple emperor *Apatura iris*, Duke of Burgundy, pearl-bordered fritillary *Bolaria euphrosyne*, small pearl-bordered fritillary *B. selene*, high brown fritillary and silver-washed fritillary *Argynnis paphia*.

Macro and micro moths

There are more than 900 species of macro-moth and over 1,500 species of micro-moth present in the UK. Green (2000) records that of these some 1,455 moth species have been recorded in the New Forest, though many have suffered recent declines and post-1980 records number considerably less than this total. As of 2001 there were some 123 species of conservation concern summarised in Table 23. Of these, about two thirds are associated with woodland habitats and a third with heathland habitats.

There are two RDB 1 (Endangered) species with post-1980 confirmed records, both of which are woodland micro-moths; *Aplota palpella* whose larvae feed in silken galleries on mosses growing on trees; and *Acrolepiosis marcidella* whose larvae live on *Ruscus aculeatus*. Two RDB 2 (Vulnerable) species, the bagworm micro-moth *Pachythelia villosella*, a heathland species whose larvae feed on *Calluna* and *Erica* species (for which the New Forest is a stronghold); and southern chestnut *Agrochola haematidea,* another heathland species whose recent finds also indicate that the Forest heathlands are a key area for this species in the UK.

In addition, there are 11 RDB 3 (Rare), 13 Notable A and 95 Notable B species of micro

and macro moths in the woodland and heathland habitats of the New Forest, with confirmed post-1980 records.

Table 22: Butterflies of conservation importance in the New Forest

Species	Habitat	Status	Distribution
Dingy skipper *Erynnis tages*	Heath, grassland and woodland rides, larvae feed on *Lotus corniculatus*	Local	Scarce; 22 post-1980 records
Grizzled skipper *Pyrgus malvae*	Heath, grassland and woodland rides, larvae feed on *Potentilla* spp.	Local	Widely distributed; 39 post-1980 records
Green hairstreak *Callophrys rubi*	Scrub and woodland edge, larvae feed on *Ulex* or *Rubus*	Local	Widely distributed; 58 post-1980 records
White-letter hairstreak *Strymonidia w album*	Woodland edge with elm; larvae feed on *Ulmus* spp.	Notable B	One post-1980 record but probably under-recorded
Silver-studded blue *Plebejus argus*	Heathland on pioneer or mature heath with bare ground. Larvae feed on newly sprouting *Calluna*, *Erica* or *Ulex*	Notable B UK BAP	Common, key stronghold for this species; 533 post-1980 records
Small blue *Cupido minimus*	Chalk grassland with *Anthyllus vulneraria*	Local UK BAP	Scarce; eight post-1980 records
Duke of Burgundy *Hamearis lucina*	Open woodland with *Primula*	Notable B UK BAP	Probably extinct in the Crown Land Inclosures; four post-1980 records
White admiral *Ladoga camilla*	Broadleaved woodland with *Lonicera*	Local	Scarce and local; 125 post-1980 records

Species	Habitat	Status	Distribution
Purple emperor *Apatura iris*	Broadleaved woodland with *Salix* spp.	Notable B UK BAP	Rare, probably attempting recolonisation from surrounding ungrazed woodland; six post-1980 records
Pearl-bordered fritillary *Bolaria euphrosyne*	Woodland edge and bracken with *Viola* spp.	Notable B UK BAP	Key stronghold for this species, though habitat in decline; 82 post-1980 records
Small pearl-bordered fritillary *Bolaria selene*	Woodland edge with *Viola* spp.	Local UK BAP	Key stronghold for this species; 56 post-1980 records
High brown fritillary *Argynnis adippe*	Woodland edge with bracken	RDB 2 UK BAP	Probably extinct; 13 post-1980 records; potential for recovery in Inclosures
Dark green Fritillary *Argynnis aglaja*	Woodland edge with *Viola* spp.	Local	Scarce; 31 post-1980 records
Silver-washed fritillary *Argynnis paphia*	Broadleaved woodland with *Viola riviniana*	Local	Frequent where conditions are suitable (e.g. Roydon, Churchplace) but scarce elsewhere. 244 post-1980 records. Great potential for recovery in Inclosures
Marsh fritillary *Eurodryas aurinia*	Chalk grassland or wet grassland with *Succisa pratensis*	Notable B UK BAP	Nine post-1980 records all from a probable reintroduction attempt at Roydon Wood
Heath fritillary *Mellicta athalia*	Open woodland with *Melampyrum pratense*	RDB 2 UK BAP	One post-1980 record from a reintroduction attempt at Roydon Wood
Grayling *Hipparchia*	Heathland and downland. Larvae feed on various	Local	Common; 394 post-1980 records

Species	Habitat	Status	Distribution
semele	grass species		

Table 23: Status of macro and micro moths in the New Forest with comparison of post 1970 and post-1980 records

Primary habitat	Status of macro and micro-moths	Number of species in each category
Woodland	RDB 1	4
	RDB 2	1
	RDB 3	8
	Notable A	8
	Notable B	65
	Total	86
Heathland	RDB 1	3
	RDB 2	2
	RDB 3	4
	Notable A	8
	Notable B	30
	Total	47
Total number of woodland and heathland species = 133		

NB: each species has been allotted to either woodland or heathland habitats; none have been recorded twice.

Status of macro and micro-moths	Post-1970 records	Post-1980 records
RDB 1	7	2
RDB 2	3	2
RDB 3	12	11
Notable A	16	13
Notable B	95	95
Total	133	123

The decline of *Lepidoptera* in the New Forest

David Green (2000) of Butterfly Conservation conducted, on behalf of the Forestry Commission, a comprehensive review of the status of *Lepidoptera* in the New Forest. While this outstanding work is primarily a collection of records, Green sets out in individual data sheets factors which he believes may have influenced the status of the scarce and threatened species. He also includes a basic summary of the known ecology, conservation and management recommendations. His work includes a comparison of *Lepidoptera* diversity from all records and those collected post-1980. The limitations of this and a cautionary note in interpreting such an analysis is discussed by Green, but his work confirms the analysis by Tubbs (1986) and Oates (1996) that there has been a significant decline in *Lepidoptera* in the New Forest from about 1960 onwards. The greatest losses appear to have been those species dependent upon a rich and structurally diverse herb and shrub layer in open woodland habitats—and this category includes most of the scarcer butterflies. Those species dependent upon tree canopy or heathland habitats appear to have fared rather better.

The principal factors for this decline are discussed by Green, but principally relate to the indiscriminate incursion of livestock into Inclosures from about 1960 onwards, together with habitat losses through intensive modern forestry operations, especially fragmentation of broadleaf woodland habitats by coniferisation.

Fortunately, many of the key management recommendations for recovery of woodland *Lepidoptera* have begun to be implemented through the transformation of management practices in the Inclosures (New Forest Forest Plan and its predecessors). In particular, the diversification of livestock grazing; restoration of a more semi-natural character through favouring native species; encouraging a more diverse age class distribution; more sympathetic ride and scrub management; and retention of old trees and dead wood habitats; have all been progressed through delivery of the New Forest Forest Plan. The Inclosures are undoubtedly the real focus for *Lepidoptera* recovery in the New Forest.

Green also notes apparent declines in Open Forest species and makes recommendations to improve habitats for *Lepidoptera*. Some of these have been and will continue to be implemented (e.g. mire restoration, Scots pine removal, sympathetic bracken and scrub management). Manipulation of grazing regimes on the Open Forest is currently not a feasible option; neither is it necessarily desirable. For a discussion of the issues surrounding livestock grazing and its differential impacts upon the various heathland and pasture woodland habitats the reader is referred to Part 3.

While considered in more detail in Part 2 of this document, our understanding of the effects of climate change continues to improve. While the picture is complex, recent studies suggest that it may pose more of a threat to UK butterflies than had been realised. In a

2015 study, researchers predicted butterfly (and moth) abundance trends over the preceding 40 years in Britain based solely on the climate, using correlations between weather variables and annual population growth of each species. One-third of the 24 butterflies studied (and half of the 131 moths) were predicted to have decreased in abundance in response to the climate, even though all were lowland species that reach a northern limit to their range within Britain. These included the white admiral, high brown fritillary, grizzled skipper and wall. Conversely, species such as orange-tip, ringlet, comma and speckled wood were predicted to have increased strongly (Butterfly Conservation; *The State of the UK's Butterflies 2015*).

Odonata: dragonflies and damselflies

Of 41 species of *Odonata* present in the UK, 27 breed in the New Forest, of which five are of conservation concern. These are listed in the following table together with their habitat preferences, status and distribution in the Forest.

Table 24: Status of New Forest *Odonata*

Species	Habitat	Status	Distribution
Southern damselfly *Coenagrion mercuriale*	Wet heaths, seepages and well vegetated streams and ditches	RDB 2 Annex II Habitats Directive Schedule 5 W&C Act IUCN VU	Restricted but locally common
Variable damselfly *Coenagrion pulchellum*	Permanent ponds and ditches	Notable B	Restricted but locally abundant
Small red damselfly *Ceriagrion tenellum*	Wet heaths, seepages, streams	Notable B	Widespread, key stronghold for this species in UK
Scarce blue-tailed damselfly *Ischnura pumilio*	Wet heaths, seepages, streams	Notable B	Widespread but scarce
Downy emerald *Cordulia aenea*	Sheltered well vegetated permanent ponds and streams	Notable B	Scarce and local

Of note is small red damselfly *Ceriagrion tenellum*, a species associated with shallow acid

bog pools, seepages and slow-moving runnels and streams with abundant *Hypericum elodes,* which probably has its UK stronghold in the New Forest wetlands.

Southern damselfly is of particular significance at the European level, being one of the Qualifying Features for which the New Forest is designated a SAC. This is dealt with in greater depth below.

Southern damselfly *Coenagrion mercuriale*

Distribution and status

The Test and Itchen River valleys and the New Forest are the UK strongholds for southern damselfly whose populations are at the northern extremity of their global range. It is globally rare having become extinct or virtually extinct in seven countries along the northern boundaries of its distribution (Belgium, Holland, Luxembourg, Slovenia, Romania, Poland and Austria) and is declining in three others (UK, Germany and Switzerland) (Stevens and Thurner, 1999). A survey (1998) visited most historical sites from which the species was known in the New Forest—in most cases, the species was found to be present. A shortage of resources prevented wider survey for new sites, but the conclusion was that the population is essentially stable in the New Forest.

The first condition assessment of the New Forest southern damselfly population was undertaken in 2005 (Harvey et al). In June and July 2013 a repeat survey of the same 22 sites in the New Forest were sampled for habitat attributes and adult southern damselfly abundance (Rushbrook et al, 2014). Of the sites assessed, six were judged to be in favourable condition, 16 in unfavourable condition. Reasons for unfavourable condition included:

- too shady/encroached by scrub (10 sites)
- too small and/or isolated (eight sites)
- concerns over lack of water or poor flow (eight sites)
- too few plants for oviposition (six sites)
- adjacent to clearly unfavourable habitat that could be restored (four sites)
- poor vegetation structure, lack of shelter for adults (three sites)
- extensive presence of bracken (two sites)
- fragmentation within site (one site)
- extensive presence of eutrophication (one site)

A repeat survey was conducted in 2019 but has not been published in time to be considered in this plan.

Ecology

In the UK, southern damselfly is largely restricted to slow-moving circum-neutral waters in streams and ditches, such as the disused water meadow systems on the Rivers Test and Itchen, as well as the heathland mires, runnels and streams supplied by base-rich waters permeating through calcareous formations, such as the Headon Beds in the New Forest.

Adults are on the wing from June to August. Flight is weak, low and they tend to stay close to the breeding site. Low shrubs are used for perching and to make feeding forays. Eggs are laid in submerged tissues of aquatic and emergent vegetation and the plant dwelling larvae usually take two years to develop. Larvae are frequently found in very shallow water (<6cm depth).

Habitat requirements (Winsland, 1998)

In the New Forest the habitat is typified by mire streams, runnels and riffles which exhibit slow water movement, areas of shallow water which warm quickly or, where deeper, a density of vegetation sufficient to support a layer of shallow water above. A southerly open aspect with natural features are thought to be important attributes for the stream with plentiful aquatic vegetation in the form of *Potamogeton polygonifolius* and *Hypericum elodes* (e.g. in M29 runnels), or in their absence rushes and sedges will suffice. Rapid flows and absence of vegetation precludes viability. Livestock grazing is very important in controlling tall herbaceous vegetation along stream edges.

While a degree of wind shelter afforded by taller bankside vegetation (e.g. *Calluna vulgaris* or *Myrica gale*) may be important, it is very important that sunlight is not significantly restricted from reaching the water. Dense *Myrica* and *Salix* scrub results in conditions becoming unfavourable for this species and the latter should be cleared from the immediate vicinity of known population centres. Shrubs which do not interrupt sunlight (north and east) are thought to be essential roosting and foraging sites and must be retained. Winsland (1998) gives further detailed management prescriptions and specific recommendations for management of important sites within the Crown Lands.

Monitoring

Habitat through condition assessment monitoring.

10-year repeat of 1998 survey to confirm presence of breeding adults and condition of key localities.

Coleoptera: beetles

Of 4,000 plus species of *Coleoptera* present in the UK, up to half have been recorded in the New Forest, of which some 240 species of conservation concern have been recorded since 1970. Approximately 54% of these are associated with the Forest woodlands and 46% with the heathlands.

They are listed with their habitat preferences and status on Table 21.

A large number are saproxylic species for which a plentiful supply of fallen and standing deadwood (often associated with living trees), of all sizes and stages of decay, is essential. The beetles exploit a range of habitat niches within this material and may feed on the wood itself, or on fungal associations living on the deadwood, or nutrient-rich sap resulting from damage to bark or from internal damage or be predatory on other saproxylic invertebrates living in and on the dead wood. For example, the false click beetle *Eucnemis capucina*, an RDB 1 species, may be found in rotting deciduous trees and in tree fungi. Species such as this feed on fungi in dead wood rather than on the dead wood itself, lacking the digestive capacity to assimilate the wood directly. The click beetle *Megapenthes lugens* is another RDB 1 species living in decaying wood. Both were included in the saproxylic beetle group statement in the UK Biodiversity Group Tranche 2 Action Plans (1999).

Other species are associated with wetland habitats from acid mire pools and runnels to base-rich flushes and Forest streams. These include nine RDB 1, three RDB 2, six RDB 3, one RDB K, four Notable A, 41 Notable B and five Notable *Coleoptera* species.

Some have been affected by past drainage schemes. *Pterostichus atterimus*, an RDB 1 ground beetle associated with *Sphagnum* in mires, has regrettably not been recorded from its former locality in the Bishop's Dyke/Denny Wood/Matley Bog area since the drainage of its peatland habitats (UK Biodiversity Group, 1999). It may now be extinct in Britain. However, there is better news in the case of the ground beetle *Tachys edmonsi*, another RDB 1 (and former BAP) species which is dependent upon wet heath, particularly in the transitional zone between mires or seepages and drier areas of wet heath (Pinchen and Williams, 2000). This species was feared extinct in the New Forest since it had not been recorded since 1936. It was targeted for survey and was rediscovered in association with another RDB 1 species *Tachys walkerianus* in long *Sphagnum* moss mounds at Millyford Bridge on the edge of Emery Down. *Aphodius niger* is another RDB 1 species which is recorded from muddy margins of temporary ponds. It feeds on decaying vegetation buried in the muddy and trampled margins of ponds. This species was listed as a Priority Species in the Biodiversity Action Plan.

Others are dependent upon animal dung and are of paramount importance in pasture nutrient recycling. These include two RDB 1, one Notable A and six Notable B species

recorded in the New Forest. (An excellent review on the biodiversity of animal dung is provided in Cox (1999), which also describes the ecological succession of this habitat and the plants and animals that are dependent upon it.) The ground beetle *Pterostichus kugelanni*, an RDB 1 species of dry sandy heathland is thought to be primarily a predator on dung beetles. Notable B dung beetles found in the Forest include *Aphodius coenosus* in dry sandy heath in cow, horse and rabbit dung, *A. conspurcatus,* mainly in wooded areas in horse dung; *A. porcus* in grasslands on cow and horse dung especially in association with *Geotrupes stercorarius* and often in their larval feeding chambers where it is cleptoparasitic; and *A. zenkeri* in woods on deer dung.

Stag beetle is of particular significance at the European level, being one of the Qualifying Features for which the New Forest is designated a SAC.

Stag beetle *Lucanus cervus*

Distribution and status

While rare and protected across some of its European range, *Lucanus cervus* is still widespread in southern England, especially in the Thames Valley, north Essex, south Hampshire and West Sussex. It also occurs fairly frequently in the Severn Valley and coastal areas of the southwest. A survey under the LIFE 2 programme organised by the Hampshire and Isle of Wight Wildlife Trust invited members of the public to send in records following instructions contained in an information leaflet published for the survey. The survey showed that the species is still fairly common and that adults are found frequently in urban situations especially gardens with suitable deadwood habitats. There were few records from the Forest itself, but that may be more a reflection of where people were concentrating survey effort than distribution of the species itself. The survey did not look at larval stages. The following provides the assessment of current status of this species by JNCC:

> *"*There is no systematic way of assessing the habitat for the species required by stag beetles. This is due to the species' preference for damp, decaying timber subterranean habitats up to 50cm underground, mainly in broadleaved woodlands and urban locations generally not open for scrutiny (such as decaying wood of artificial structures/fence posts and in compost heaps in gardens). Despite this, expert opinion suggests that the area and quality of occupied habitat for the species is sufficient*."*
> *(*Article 17 report to Europe which concludes status across UK sites is 'favourable').

Ecology and habitat requirements

Lucanus cervus is a species of broadleaved woodland, pasture woodland, parkland and

gardens where concentrations of suitable deadwood accumulate. The larvae live in the dead and decaying wood of deciduous trees, often in roots and stumps, taking at least three and a half years to mature.

Monitoring

Occasional repeat of Hampshire and Isle of Wight Wildlife Trust-style census of adult beetle distribution.

No method has yet been found to relate results of population sampling to population size.

Hymenoptera: ants, wasps and bees

Among the 6,000-or-so UK *Hymenoptera* species, some 43 species of conservation concern have been recorded in the New Forest since 1970. All but three are primarily associated with heathland habitats, many being dependent upon dry heathland with south-facing bare sandy slopes. They are listed with their habitat preferences and status on Table 21.

Of the four RDB 1 heathland species, two were listed as Priority Species in the UK Biodiversity Action Plan. The first is black bog ant *Formica candida* which has its stronghold in those New Forest mires which are unaffected by drainage and maintain sufficient structure to enable nest construction in the upper parts of *Molinia* tussocks. North (1998) systematically searched 26 sites but only found six colonies. A survey during the LIFE 2 programme revealed that this species is probably more widespread than previously considered and currently some 25 sites have colonies (Cooch, 2000 [unpublished]). It is also apparent from this later work that prescribed burning and grazing are probably essential requirements to maintain mire habitats in favourable condition. In 2016 Bournemouth University undertook a further survey for black bog ant. Of the 48 sites surveyed, a total of 33 sites were considered to have suitable habitat to support *F. candida* populations. Nests of *F. candida* were recorded at 17 of these sites. The total number of nests recorded across these 17 sites was 41. Across the 38 sites for which historical records were available, 12 showed a decrease in the number of nests recorded, six showed an increase and 20 demonstrated no change within the last 20 years.

The second species is *Homonotus sanguinolentus*; a predator of spiders of the genus *Cheiracantheum* which was recorded from Cranes Moor in 1990 and is associated with wet heath (English Nature, 1996).

The remaining two RDB 1 species together with the bulk of the three RDB 2, 17 RDB 3, five Notable A and seven Notable species are dependent upon dry sandy heathland with bare

south-facing slopes. Many are parasitic on *Andrena* bees.

The dark guest ant *Anergates atratulus*, an RDB K (and former UK BAP) species, is parasitic in the colonies of another ant species *Tetramorium caespitum*, itself a locally distributed species. It has been recorded on dry heathland around Beaulieu Road Station.

Diptera: flies

Among the 6,000-or-so UK *Diptera* species, some 149 species of conservation concern have been recorded in the New Forest since 1970. Of these, about one third (49) are associated with woodland habitats and two thirds (100) with heathland habitats. They are listed with their habitat preferences and status on Table 21.

The vast majority of woodland species are associated with dead wood and like *Coleoptera* exploit the full range of niches afforded by this resource. One RDB 1 species has been recorded, *Caliprobola speciosa*, a strikingly beautiful hoverfly largely confined to the New Forest and Windsor Forest. The larvae live in well decayed wet wood in the base of decaying tree trunks or roots. Among the 10 RDB 3 species is *Ctenophora flaveolata,* a large cranefly confined to old woodland in southern England. Its larvae live in rotting deciduous wood. Nine RDB 2 species have been recorded including the bee mimic hoverfly *Brachypalpus laphriformis* a species associated with old decaying trees, though its precise larval requirements are largely unknown.

Diptera dependent upon heathland habitats include six RDB 1, four RDB 2, 18 RDB 3 and 23 Notable B species. The full range of heathland habitats is exploited from mires to dry heath, grassland, livestock dung and bare ground. Among the heathland species four are listed as Priority Species in the former UK BAP. These include the hoverfly *Eristalis cryptarum* (RDB 2) a species which has suffered a major contraction in range and is now probably extinct in the New Forest, being only recently recorded from a small cluster of mires on Dartmoor. The second former BAP species is the RDB 3 mottled bee-fly *Thyridanthrax fenestratus* for which the New Forest is a national stronghold. It is a species of open heathland dependent upon sparsely vegetated or bare sandy ground (e.g. paths). It is considered to be either a parasitoid of the sand wasp *Ammophila pubescens* or of the caterpillars which the wasp collects to feed its larvae in burrows in bare sand although the association requires confirmation (UK Biodiversity Group Tranche 2 Action Plans 1999). The third species is the hoverfly *Chrysotoxum octomaculatum,* a wasp mimic confined to southern England with strongholds in the New Forest and Dorset heathlands. Its ecological requirements are not well understood. The fourth species is the hornet robberfly *Asilus crabroniformis* a grassland species dependent upon desiccated dung of grazing animals upon which the adults perch and lay eggs. Adults feed on a variety of insects including grasshoppers, dung beetles and flies.

Repeated surveys of 13 valley mire systems between 2004 and 2009 produced a list of 716 species representing 49 families including 78 species regarded as Nationally Scarce or rarer. Falk concluded that the fly fauna of the New Forest mires is distinctive with a good number of specialities that are rare or absent at mires elsewhere. The mire fauna is strongly influenced by the large number of feral and wild large grazing animals producing one of the finest tabanid (horsefly) assemblages in Britain.

In 2017-18 the re-survey of a historical site for the globally endangered six-spotted cranefly *Idiocera sexguttata* at Stony Moors was undertaken by Bournemouth University (Knul et al, 2018). This Section 41 species was not found during the 2017 survey season but was successfully re-recorded here in 2018 (13 individuals).

Orthoptera: grasshoppers, crickets and cockroaches

Of 30 native species at least 22 occur in the New Forest (Tubbs, 1986) including 12 of conservation concern. Of these, four are associated with woodland habitats and eight with heathland habitats. They are listed with their habitat preferences and status on Table 21.

The four woodland species comprise one Notable A, *Nemobius sylvestris*, and three Notable B species: *Ectobius lapponicus, E. pallidus* and *Omocestus rufpes*, all of which require warm sunny rides and glades with some scrub and leaf litter.

The heathland *Orthoptera* include one RDB 1, one RDB 2, one RDB 3, two Notable A and three Notable B species. Of these, three are listed as Priority Species in the UK BAP. The first, mole cricket *Gryllotalpa gryllotalpa*, is a serious agricultural pest in Ukraine and over much of its range—it has been rediscovered in the Forest.

The second species, large marsh grasshopper *Stethophyma grossum* is restricted to very wet marshy areas and its range has contracted to surviving colonies in the New Forest and Dorset heathlands. The Species Recovery Programme report following surveys in 1997-1998 (English Nature, 1998) revealed colonies in six confirmed localities in the New Forest mires (Upper and Lower Crockford Bottom, Hincheslea Bog, Peaked Bottom, Below Clumber Inclosure and Duck Hole Bog). A further 11 sites with previous colonies revealed no evidence of this species; and though further survey may reveal more as yet unreported colonies, the apparent decline from this last remaining UK stronghold is of concern. The report describes a pilot study to assess the habitat affinity of the species and concludes that *Stethopyma grossum* is localised within *Sphagnum* mire or mire/wet heath transitions and is excluded from wet heath per se and dry heath habitats. Strong correlations were found between *S. grossum* activity and percentage cover of sphagna, *Rhynchospora alba* and areas of exposed surface water. There was a negative correlation with shrub and *Molinia* cover. More recently, a more comprehensive survey for large marsh grasshopper (LMG)

was undertaken (Harvey and Brock, 2017). During 2017 the species was recorded at 27 of the 50 sites surveyed. Four sites were assessed as supporting a 'Strong' population, with another 15 supporting a 'Moderate' population. For the 30 sites that had also been surveyed in the 1990s there was little change, with only two sites having apparently gained LMG and two having apparently lost LMG in the 20 years between the two survey periods.

The third species is *Chorthippus vagans*, a species of dry heath confined to Dorset and the New Forest. It feeds readily on *Calluna,* favouring mature heath but with a diversity of successional stages, particularly on south-facing slopes (Sterling, 1997).

Hemiptera: bugs

Of 540 species of *Hemiptera* present in the UK, nine species of conservation concern have been recorded have been recorded in the New Forest since 1970. Three of these are associated with the Forest woodlands and six with the heathlands. They are listed with their habitat preferences and status on Table 21.

The New Forest cicada, *Cicadetta montana*, has declined across its European range though is commoner in Russia and the Caucasus. In the UK it is known with certainty only from two areas in the New Forest in the last 50 years (UK Biodiversity Group Tranche 2 Action Plans 1999). In 1986 there was a peak (30 turrets recorded). On a second site singing has been heard occasionally up to 1994 and an adult was collected in 1990. In 1996 and 1997 no evidence of cicadas was found despite concerted efforts (Pinchen and Ward, 1997). Subsequent surveys funded through the Species Recovery Programme failed to confirm the presence of this species, although there are unconfirmed reports from 2000. *Cicadetta montana* is a species of warm, south-facing open scrub and woodland edge. The life cycle from egg to adult takes eight years. Nymphs feed on *Molinia* and woody plants and build emergence turrets in March prior to emerging as adults in May and June. Adults live for about three weeks. In recent years a mobile phone app was developed specifically for New Forest cicada—an excellent example of citizen science in action. In 2013, Buglife undertook an assessment of 56 sites and subsequently surveyed the 19 most suitable for the species (Buglife, 2014). Despite suitable habitat and largely favourable weather conditions, no evidence of *C. montana* was recorded during the 2013 survey season.

The four RDB 3 heathland species are associated with valley mires in the New Forest.

Crustacea

Two species are of conservation concern, both dependent upon temporary ponds in the grazed heathland matrix. The tadpole shrimp *Triops cancriformis* is classified as Endangered and is protected under Schedules 5 and 9 of W&CA 1981. This species is restricted to just a few ponds in the New Forest and the Solway Firth in the UK.

Such ponds dry out in summer eliminating predators and competitors. The species has a rapid development and is able to mature from egg to adult in two to three weeks following wetting. It is omnivorous, feeding on small aquatic invertebrates, aquatic plants and microscopic particles extracted from sediment (UK Biodiversity Group Tranche 2 Action Plans 1999).

The fairy shrimp, *Chirocephalus diaphanus*, is classified as Vulnerable and is protected under Schedules 5 and 9 of W&CA 1981. This species is restricted to just a few strongholds including the New Forest the mawn pools of Powys in Wales and Salisbury Plain. This species is a filter feeder utilising minute algae, protozoans and detrital particles (Bratton, 1990). Its long-lived drought resistant eggs remain in the pond bed during dry spells, hatching some hours after wetting. Young *Chirocephalus* pass quickly through several moults and begin producing eggs after a few days. This strategy enables the species to avoid predation by other colonising species and it can take advantage of any temporary water body provided it can colonise it. This would appear to be a restricting factor in the spread of *Chirocephalus* in the Forest, though one would have thought mud in animal hooves could transmit the species from pond to pond. On Salisbury Plain in Wiltshire, the national stronghold of the species, military vehicles create enormous numbers of ephemeral ponds in the form of ruts and craters—undoubtedly, they are instrumental in distributing the species widely across the Plain. It would be an interesting if controversial experiment to borrow a 70-ton Challenger tank from the Ministry of Defence for a weekend in order to create more extensive habitats for *Chirocephalus, Triops* and a whole host of other invertebrates dependent upon bare ground which may be effectively created by such ‘tank grazing’.

While the presence of livestock is important in keeping the ephemeral ponds open and providing nutrient input in the form of dung, aquatic *Crustacea* are highly susceptible to the toxic effects of certain veterinary compounds excreted in livestock dung. The colonisation and swamping of the key pools by *Crassula helmsii* is also something to be prevented.

A 2013 survey collated historical records yielding 31 ponds with confirmed records since 1985. However, some of these are outside the HLS agreement area of the New Forest and were therefore excluded from this survey. Of the 28 locations surveyed, three ponds supporting tadpole shrimp and nine ponds supporting fairy shrimp were recorded (Aquilina, 2014).

Mollusca: snails

Heathland habitats are not rich in molluscs, being generally too acidic for shell deposition. However, the New Forest is a stronghold for *Lymnaea glabra*, an RDB 2 species which survives in softer waters of small muddy pools and ditches, especially those which dry out periodically (Sterling, 1997).

Annelida: segmented worms

New Forest ponds are also a national stronghold for medicinal leech *Hirudo medicinalis*, an RDB 3 species protected under Schedule 5 of W&CA 1981. It would appear to favour eutrophic ponds with dense stands of water plants (submerged and marginal), good supply of tadpoles (on which the leech larvae feed) and availability of larger vertebrate hosts (livestock) for the adult leeches. The species is not drought resistant but does require shallow, unshaded ponds for water to reach optimum temperature (19°C for breeding, (Sterling, 1997)).

Four ponds originally surveyed in 1999 were re-surveyed in 2016 (Aquilina, 2016). Medicinal leech appeared to have increased in population size in two of the ponds, decreased in one and become extinct in the fourth since the 1999 surveys. The leech population had responded well to management to remove shading influences (scrub) at certain ponds. However, in the fourth pond the shading effect of crassula had caused the loss of the leech population.

Aranea: spiders

In 2018 a survey was commissioned to improve our understanding of this under-recorded New Forest fauna (Wilson, 2019). A total of 352 species of spider had previously been recorded. While there have been records in every decade since the 1940s, almost two-thirds of species had not been documented in 30 to 80 years since they were first recorded between the 1940s and 1980s. Only two periods would seem to have experienced a concerted effort: the 1940s and the 1960s, with all remaining data collected on an ad hoc basis or derived from brief forays by visiting specialists.

The 2018 surveys added an additional 17 species; of which four are entirely new to the New Forest. Of the 10 target species which the surveys were focusing on, five were re-recorded during 2018: *Uloborus walckenaerius, Haplodrassus dalmatensis, Sitticus caricis, Saaristoa firma* and *Tapinocyba mitis*. All of these are key species, defined as those with a nature conservation status.

Of the 119 species of spider recorded in 2018, 24 are key species, representing 20% of the fauna and a clear indication of the overwhelming national importance of the New Forest for spiders. Two spiders, not target species: *Philodromus emarginatus* and *Xysticus robustus*, are very rare or exceptionally rare species; the latter having not been recorded anywhere in Britain in two decades. A further two species, both money-spiders (*Drepanotylus uncatus* and *Silometopus elegans*) are rare in vice-county 11 (South Hampshire).

New Forest lichens

No lichen species are Qualifying Features of the New Forest SAC but its woodlands and heathlands support an outstanding assemblage of rare and scarce lichens. Over the past 20 years a large number of lichen records have been verified and catalogued by Neil Sanderson, supporting the case the New Forest SAC to be of international importance for lower plants in both woodlands and heathlands. At the time of writing, Sanderson updates and manages this database on behalf of the British Lichen Society (BLS).

Of the 2,390 taxa of lichens or closely associated fungi recorded in the British Lichen Society (BSL) checklist (Simkin, 2003) 718 have been recorded from the New Forest SAC since 1967, representing some 30% of the British and Irish flora (Sandell and Rose, 1996; Sanderson, 1998; Sanderson, 2020). This excludes weedy species that have invaded broken concrete, as these have not yet been surveyed in detail. There are likely to be a further 20 to 30 species in this habitat. In addition, there are 13 reliable 19th century records of species that have not been subsequently re-discovered. Of these 718 species recorded since 1967, 71 are of conservation concern. This represents 10% of the recently recorded SAC lichen flora. From the total of 718 species recorded, 535 (74%) are epiphytes, predominately found in the pasture woodlands and 183 (26%) are heathland species growing on a range of substrates including heather stems, bare rock and soil, mosses and aquatic environments. Lichens and associated fungi of conservation concern are listed on Table 25.

Over 350 checklist taxa have been recorded from the pasture woodlands of the SAC and this is clearly the single most significant habitat in the SAC for lichens (Sanderson, 1998). A further associated 27 fungi, mainly lichen parasites, have also been recorded. The pasture woodlands carry a lichen flora that is rich in species characteristic of old growth stands (i.e. with a stand continuity greater than 200 years) and this flora is of the highest international importance. This is due to the destruction of old growth pasture woodland by forestry management across the northern temperate zone (Vera, 2000). For example, the pasture woodlands support 48 species listed in a draft of International Responsibility Species (i.e. species which Britain holds a significant proportion of the European or world population). Most of these species still have large viable populations in the New Forest but are very rare and threatened beyond Britain. In this context, one of the most important communities is

that found on the dry bark of ancient oaks, characterised by species such as *Lecanactis premnea* and *Lecanactis lyncea*. The latter species, which is not even nationally scarce in Britain, is otherwise known from a handful of ancient oaks in France, while the former BAP species, *Enterographa sorediata*, which is endemic to Britain, also occurs. This community, endemic to western Europe, is at its most extensive anywhere in Europe within the SAC.

A single near threatened native pinewood species, *Calcium parvum*, has colonised pine in pasture woodland. The pine grows in conditions similar to those found pasture woodland native pinewoods. This lichen is presumably a recently arrived species.

The primary factors in maintaining this flora are (Sanderson, 1998):

- Long stand continuity. The majority of the old growth dependant species require between 200 to 300 years of stand continuity to colonise. The species of dry bark on ancient oak require over 400 years of stand continuity. This implies low levels of, or no, timber cropping.

- Varied and generally high light levels. These are maintained by long periods of grazing pressure high enough to suppress most regeneration. Dense regeneration casts a heavy shade that eliminates all species of conservation concern. In the SAC the spread of a dense holly understorey since the late 19th century is a major threat.

- Very sheltered habitats that maintain longer periods of humidity than found outside woodlands but also dry out periodically. (Continuous high humidity favours bryophytes.) These conditions are favoured by the glade and grove structure that develops in pasture woodlands with long periods of low regeneration and pluses of regeneration.

- Varied tree and shrub composition. Lichens have very narrow niches and old growth specialists can occur on many specific niches on specific species of tree. Important habitats include base-rich bark on species such as oak, beech, ash and maple, mesic bark on oak, strongly acid bark on oak, beech and alder, smooth bark on old holly, hazel and beech, rain and wound tracks on beech, dry bark on ancient oaks and dry lignum on standing trees. The full range of trees and associated bushes need to regenerate and survive into old age.

Air pollution and its impacts on lower plants is considered in Part 2 of this document.

The following table lists lichens and associated fungi recorded from the New Forest woods and heathlands since the 1960s. It covers the New Forest SAC and Brockenhurst Park (one species noted below) (Sanderson, 2020).

Table 25: New Forest lichens of conservation concern (including associated fungi)

Threatened, Near Threatened and Notable Lichens (Nb-Notable, NT-Near Threatened, VU-Vulnerable, EN-Endangered, CR-Critical, EX-Extinct)			
Threatened	**Status**	**Habitat**	**Note**
Anaptychia ciliaris	EN	Woods	
Arthonia anglica	EN	Woods	Recently rediscovered
Bacidia circumspecta	VU	Woods	
Bacidia incompta	VU	Woods	
Bacidia subturgidula	CR	Woods	
Buellia hyperbolica	VU	Woods	
Calicium diploellum	CR	Woods	
Calicium hyperelloides	CR	Woods	
Caloplaca flavorubescens	EN	Woods	Only Langley Woods NNR and not seen since 1994
Caloplaca herbidella	VU	Woods	
Cladonia mediterranea	CR	Heaths	
Collema fragrans	EN	Woods	
Cryptolechia carneolutea	VU	Woods	
Enterographa brezhonega	VU	Woods	
Enterographa elaborata	CR	Woods	
Lecanora quercicola	VU	Woods	
Lecanora strobilina	VU	Woods	
Megalaria laureri	EN	Woods	
Pertusaria pustulata	VU	Woods	
Pyrenula nitida	VU	Woods	
Pyrenula nitidella	EX	Woods	Discovered recently
Ramonia nigra	CR	Woods	
Rinodina colobinoides	VU	Woods	Brockenhurst Park only
Schismatomma graphidioides	VU	Woods	
Strigula stigmatella	EN	Woods	Not seen since 1970

Teloschistes chrysophthalmus	CR	Woods	
Varicellaria velata	VU	Woods	
Near Threatened	**Status**	**Habitat**	**Note**
Agonimia octospora	NT	Woods	
Arthonia invadens	NT	Woods	
Arthonia zwackhii	NT	Woods	
Byssoloma leucoblepharum	NT	Woods	
Calicium parvum	NT	Woods	
Calicium tigillare	NT	Woods	Not seen since 1971
Chaenothecopsis caespitosa	NT	Woods	
Chaenothecopsis savonica	NT	Woods	
Cladonia phyllophora	NT	Heaths	
Cladonia rei	NT	Heaths	
Coenogonium 'Porina rosei'	NT	Woods	The taxa known as *Porina rosei* until very recently
Collema occultatum	NT	Woods	Not seen since 1972
Enterographa sorediata	NT	Woods	
Gyalecta flotowii	NT	Woods	
Heterodermia obscuratum	NT	Woods	Not seen recently
Lecania chlorotiza	NT	Woods	Only Langley Woods NNR
Lecanora sublivescens	NT	Woods	
Leptogium palmatum	NT	Heaths	
Megalospora tuberculosa	NT	Woods	
Melaspilea amota	NT	Woods	
Micarea hedlundii	NT	Woods	
Minutophoma chrysophthalmae	NT	Woods	
Mycoporum lacteum	NT	Woods	

Ochrolechia arborea	NT	Woods	
Opegrapha prosodea	NT	Woods	
Parmeliella testacea	NT	Woods	Lost to shade, last seen 1988
Parmelinopsis horrescens	NT	Woods	
Parmotrema arnoldii	NT	Woods	Not seen since the 1970s
Phaeographis lyellii	NT	Woods	
Phlyctis agelaea	NT	Woods	
Porina hibernica	NT	Woods	
Ramonia chrysophaea	NT	Woods	
Ramonia dictyospora	NT	Woods	
Rinodina isidioides	NT	Woods	
Stictographa lentiginosa	NT	Woods	
Synarthonia astroidestera	NT	Woods	
Syncesia myrticola	NT	Woods	
Tylophoron hibernicum	NT	Woods	
Usnea articulata	NT	Woods	
Usnea esperantiana	NT	Woods	
Usnea florida	NT	Woods	
Wadeana dendrographa	NT	Woods	
Wadeana minuta	NT	Woods	
Xerotrema quercicola	NT	Woods	
Notable	**Status**	**Habitat**	**Note**
Acolium sessile	Nb	Woods	
Agonimia allobata	Nb	Woods	
Agonimia flabelliformis	Nb	Woods	
Agonimia gelatinosa	Nb	Heaths	
Agonimia globulifera	Nb	Heaths	
Anisomeridium robustum	Nb	Woods	
Anisomeridium viridescens	Nb	Woods	
Antennulariella lichenisata	Nb	Woods	

Arthonia anombrophila	Nb	Woods	
Arthonia graphidicola	Nb	Woods	
Arthonia ilicina	Nb	Woods	
Arthonia thelotrematis	Nb	Woods	
Arthopyrenia nitescens	Nb	Woods	
Arthothelium ruanum	Nb	Woods	
Arthrorhaphis aeruginosa	Nb	Woods	
Arthrorhaphis grisea	Nb	Heaths	
Bacidia absistens	Nb	Woods	
Bacidia assulata	Nb	Woods	
Bacidia friesiana	Nb	Woods	
Bacidina squamellosa	Nb	Woods	
Bactrospora corticola	Nb	Woods	
Biatora britannica	Nb	Woods	
Buellia erubescens	Nb	Woods	
Byssoloma marginatum	Nb	Woods	
Caloplaca asserigena	Nb	Woods	
Caloplaca haematites	Nb	Woods	
Catinaria "isidioides"	Nb	Woods	Awaiting description, probably NT
Chaenotheca hispidula	Nb	Woods	
Chaenotheca stemonea	Nb	Woods	
Chaenothecopsis australis	Nb	Woods	Provisional identification
Chaenothecopsis nigra	Nb	Woods	
Chaenothecopsis pusilla	Nb	Woods	
Chaenothecopsis retinens	Nb	Woods	
Cladonia borealis	Nb	Heaths	
Cladonia callosa	Nb	Heaths	
Cladonia cariosa	Nb	Heaths	
Cladonia cyathomorpha	Nb	Woods	
Cladonia incrassata	Nb	Woods	

Cladonia zopfii	Nb	Heaths	
Cliostomum flavidulum	Nb	Woods	
Coenogonium tavaresianum	Nb	Woods	Recently discovered, probably at least VU
Cresponea premnea	Nb	Woods	
Eopyrenula grandicula	Nb	Woods	
Felipes leucopellaeus	Nb	Woods	
Francisrosea bicolor	Nb	Woods	Taxa in ed. probably at least NT
Fuscopannaria mediterranea	Nb	Woods	
Graphis handelii	Nb	Woods	
Gyalecta derivata	Nb	Woods	
Hypotrachyna sinuosa	Nb	Woods	Not seen since 1972
Hypotrachyna taylorensis	Nb	Woods	
Inoderma subabietinum	Nb	Woods	
Lecanographa lyncea	Nb	Woods	
Lecanora albellula	Nb	Woods	
Lecanora alboflavida	Nb	Woods	
Lecanora sarcopidoides	Nb	Woods	
Lecidea nylanderi	Nb	Woods	
Leptogium intermedium	Nb	Heaths	
Leptogium subtile	Nb	Woods	
Leptogium tenuissimum	Nb	Heaths	
Leptorhaphis atomaria	Nb	Woods	
Leptorhaphis maggiana	Nb	Woods	
Lobaria amplissima	Nb	Woods	
Lobaria pulmonaria	Nb	Woods	
Lobaria virens	Nb	Woods	
Melaspilea ochrothalamia	Nb	Woods	
Micarea adnata	Nb	Woods	
Micarea alabastrites	Nb	Woods	

Micarea doliiformis	Nb	Woods	
Micarea misella	Nb	Woods	
Micarea myriocarpa	Nb	Woods	
Micarea pycnidiophora	Nb	Woods	
Micarea xanthonica	Nb	Woods	
Microcalicium ahlneri	Nb	Woods	
Milospium graphideorum	Nb	Woods	
Mycocalicium subtile	Nb	Woods	
Nephroma laevigatum	Nb	Woods	Lost in 1986
Opegrapha corticola	Nb	Woods	
Opegrapha fumosa	Nb	Woods	
Opegrapha thelotrematis	Nb	Woods	
Opegrapha viridis	Nb	Woods	
Opegrapha xerica	Nb	Woods	
Pannaria conoplea	Nb	Woods	
Parmelinopsis minarum	Nb	Woods	
Pectenia plumbea s. str.	Nb	Woods	Not seen since the 1980s
Peltigera neckeri	Nb	Heaths	
Pertusaria amara f. pulvinata	Nb	Woods	
Pertusaria coronata	Nb	Woods	
Phaeographis inusta	Nb	Woods	
Phaeophyscia endophoenicea	Nb	Woods	
Phyllopsora rosei	Nb	Woods	
Placynthiella oligotropha	Nb	Heaths	
Porina borreri	Nb	Woods	
Porina byssophila	Nb	Woods	
Porina coralloidea	Nb	Woods	
Porina rosei	Nb	Woods	The senso strica taxa, potentially CR
Protoparmelia oleagina	Nb	Woods	

Psilolechia clavulifera	Nb	Woods	
Pycnora sorophora	Nb	Woods	
Ramonia interjecta	Nb	Woods	
Rhaphidicyrtis trichosporella	Nb	Woods	
Rinodina exigua	Nb	Woods	
Rinodina roboris var. roboris	Nb	Woods	
Ropalospora viridis	Nb	Woods	
Schizotrema quercicola	Nb	Woods	
Snippocia nivea	Nb	Woods	
Sphinctrina tubiformis	Nb	Woods	Probably EN
Sphinctrina turbinata	Nb	Woods	
Sporodophoron cretaceum	Nb	Woods	
Steinia geophana	Nb	Woods	
Sticta limbata	Nb	Woods	
Strangospora deplanata	Nb	Woods	Probably CR
Strigula jamesii	Nb	Woods	
Strigula phaea	Nb	Woods	
Strigula sp A	Nb	Woods	
Strigula tagananae	Nb	Woods	Probably VU
Strigula taylorii	Nb	Woods	
Trapeliopsis glaucolepidea	Nb	Heaths	
Vezdaea retigera	Nb	Woods	

Totals:						
Woodlands						
All taxa	Lichens	Lichenicolous fungi	Associated fungi	Threatened	Near Threatened	Notable
535	448	64	23	26	41	105
Heathlands						

All taxa	Lichens	Lichenicolous fungi	Associated fungi	Threatened	Near Threatened	Notable
183	171	11	1	1	3	16
All habitats						
All taxa	Lichens	Lichenicolous fungi	Associated fungi	Threatened	Near Threatened	Notable
718	619	75	24	27	44	121

Lichens are also a significant component of other habitats, particularly dry heaths (in the wide sense), parched acid grassland and flint pebbles in streams within the pasture woodlands. A total of 183 species have been recorded from these habitats with four of these of conservation concern. The lichen flora of the heaths is particularly well developed and includes many species such as *Cladonia strepsilis* and *Pycnothelia papillaria* which have seriously declined in the lowlands but are still widespread (but not common) in the uplands. This heathland lichen flora is national significance as the best-preserved lowland heathland lichen flora and contributes significantly to the international importance of the heathlands.

The primary factors in maintaining this flora are (Sanderson, 1996):

Lichens are light demanding and their maintenance in heathland requires constant low-level disturbance or periodic heavy disturbance that prevents dominance by dwarf shrubs. The former is provided by localised heavy grazing maintaining prostrate heath, the latter by fire or ground disturbance.

The relationship between fire and heath lichens is complex. Without fire, lichen diversity is lost from lightly or ungrazed grazed heaths. Lichens prefer hard humus as a substrate and few species are found in heath with accumulations of loose litter. This is not removed by occasional mowing, only by fire. The lichens are quite slow to recover from fire however and require open conditions to be maintained for many years. Recovery from cool controlled fires is more rapid, with plants fully grown within six years or so. After hot wildfire recovery takes more than a decade, as extra time is required for the colonisation of the sterilised soil.

Low nutrient status is required as most heath lichens cannot compete with grass growth between the heathers. Nitrogen pollution could, in theory, have a negative effect but this has not actually been demonstrated as lichens also decline with the abandonment of grazing and excessive fire control. The latter results in increasingly damaging hot fires. Areas beyond the New Forest with high nitrogen deposition showing a decline in lichen diversity mostly suffer from these other negative factors. Also abandoned heaths in areas of low nitrogen deposition also show similar declines in lichen diversity.

New Forest vascular plants

Over the past 20 years further botanical surveys and associated records have been made. For further information, in the first instance contact Hampshire Biodiversity Information Centre.

No vascular plant species are Qualifying Features of the New Forest SAC but the vegetation composition of the New Forest SAC habitats is very diverse largely due to the long history of grazing by commoners' livestock. Many are considered to be a particularly special and distinguishing component of the New Forest SAC. Of the 1,500 native vascular plants recorded from Britain about 540 have been recorded from the Crown Lands and commons (estimated from Brewis et al, 1996) within the New Forest SAC, representing some 36% of the British flora. The private lands within the SAC support somewhere between 10 to 20 additional species. Of these, 41 native species of conservation concern have been recorded in the last 50 years, although this includes the probably casual, but natural, occurrence of *Eryngium campestre* and *Polypogon monspeliensis*. In addition, the nationally scarce large leaved lime has been naturalised from definitely planted trees. All but one, *Lobelia urens*, are found on the Crown Lands or private commons. *Spiranthes aestivates* was exterminated by collecting destroying the viability of the population followed by drainage damage in the middle of the 20th century (Cox, 1996). Vascular plants of conservation concern together with their habitat requirements and status are listed on Table 26.

Of the remaining 39 species, only three are purely woodland species *Thelypteris palustris*, *Melittis melissophyllum* and *Polygonatum odoratum*, the latter in its only native acid woodland site in Britain, while two, *Carex montana* and *Pulmonaria longifolia*, are shared between woodlands and heathland. 13% are woodland species and 92% are heathland species. This reflects the much larger number of grazing dependant species found in heathlands and the larger scale of habitat destruction of heathlands. Within the heathland there is a similar pattern as that described by Byfield and Pearman (1996) for the Dorset Heaths, with few species of conservation concern found in dry heath but with rich floras in ephemeral ponds (12 species) and grasslands and associated scrub in general (13 species). *Orobanche rapum-genistae* found in old gorse bushes, a few small native populations of *Erica ciliaris* and *Viola lactea* in grassy H3c heaths are the only dry heath species.

Parched acid grassland is the richest individual grassland type with several nationally scarce species including *Crassula tillaea*, *Hypochaeris glabra* and *Lotus subbiflorus* but nationally important populations of *Chamaemelum nobile* are found in wetter grasslands as well as parched acid grassland (Winship, 1993). Heathy acid grassland adds species such as *Lobelia urens* and *Viola lactea*. The acid grasslands of the New Forest were found to

support a nationally important flora during an assessment of English lowland acid grassland (Sanderson, 1998). This includes many characteristic species that are not listed as nationally scarce but are clearly declining in Britain, e.g. *Moenchia erecta*, or the lowlands, e.g. *Sagina subulata*. Associated habitats, herb-rich bracken and thorny scrub support the near threatened species *Gladiolus illyricus* and *Rosa agrestis* respectively.

The jewel in the crown of the New Forest flora is undoubtedly the ephemeral ponds. These harbour the main concentration of RDB species in the SAC, including the vulnerable *Mentha pulegium* and *Pulicaria vulgaris* and two near threatened species *Galium constrictum* and *Ludwigia palustris*. A possibly native occurrence of the Annex II species *Luronium natans* has also been discovered. A detailed account of the status, distribution and management requirements for *Pulicaria vulgaris* is given in a recent HLS-funded study by Chatters et al (2014). The Forest supports the highest population of this plant dependent as it is on cattle poached areas around pool edges—once again demonstrating the ecological importance of disturbed ground in perpetuating such species. The forest supports the best-preserved heathland ephemeral pond assemblage in Britain and one of international significance. All the ephemeral pond species are highly dependent grazing to maintain the open nature of the ponds. Invasion by exotic water plants introduced by the horticultural trade is a major threat.

Wet heaths and mire hold a scatter of species with nationally significant populations of *Hammarbya paludosa* in the valley bogs and *Lycopodiella inundata* and *Rhynchospora fusca* in open wet heath (M16c). The vulnerable *Eriophorum gracile* had several important populations in transition mires but these had dwindled with the spread of scrub (Winship, 1994). Subsequently, in the last 20 years, Forestry England has undertaken scrub removal and mire restoration at two of the three known locations for this species which has provided conditions for the local recovery of *E. gracile* (Chatters and Sanderson, 2014).

As well as the species of national conservation concern the mires are notable for the occurrence of mainly northern species, some of which are very rare in the lowlands. The transition mires are especially notable in this respect, with species such as *Carex limosa* and *Carex lasiocarpa* occurring as well as the vulnerable *Eriophorum gracile*. In this habitat the *Utricularia intermedia* recorded from the Denny Bog complex is the nominate member of the *Utricularia intermedia* aggregate. This may be a lowland species and absent from the uplands and as rare and threatened as *Eriophorum gracile*.

Rich wet grassland floras are also typical of the wet lawns with numerous species that have declined in the lowlands due to agricultural intensification or abandonment, e.g. *Eleocharis quinqueflora* and *Anagallis tenella* but this habitat lacks nationally threatened species.

Table 26: New Forest vascular plants of conservation concern, habitat requirements and status. Key: BAP = Biodiversity Action Plan; IR: Introduced

Habitat	Group	Species	Requirements	European	National	IR	Status
Mire	Vascular plant	*Spiranthes aestivalis*	In M21a valley bogs, exterminated by collecting		Extinct		0
Wet lawn	Vascular plant	*Leersia oryzoides*	Flood channels in wet lawn		Endangered	Yes	1
Transition mire	Vascular plant	*Eriophorum gracile*	Mildly base-enriched very wet mire (M9 related)		Vulnerable		1
Neutral green	Vascular plant	*Eryngium campestre*	Casual occurrence in green lane		Vulnerable		1
Heathy acid grassland	Vascular plant	*Lobelia urens*	Seasonally damp heathy M25b/U1		Vulnerable		1
Ephemeral ponds	Vascular plant	*Mentha pulegium*	Nutrient enriched ephemeral ponds		Vulnerable	Yes	1
Ephemeral ponds	Vascular plant	*Pulicaria vulgaris*	Nutrient enriched ephemeral ponds		Vulnerable		1
Humid heath	Vascular plant	*Erica ciliaris*	Very rare native in humid heath (H2c)		Near Threatened		1
Ephemeral ponds	Vascular plant	*Galium constrictum*	*Littorelletalea* ephemeral ponds		Near Threatened		1
Bracken	Vascular plant	*Gladiolus illyricus*	Herb-rich bracken		Near Threatened		1
Ephemeral ponds	Vascular plant	*Ludwigia palustris*	Nutrient enriched ephemeral ponds		Near Threatened		1
Scrub	Vascular plant	*Rosa agrestis*	Scrub on Headon Beds (W21)		Near Threatened		1
Heathland and Wood pasture	Vascular plant	*Carex montana*	Varied (U3, U20, M16b and W8b)		Nationally scarce		1

Habitat	Group	Species	Requirements	European	National	IR	Status
Heathland	Vascular plant	*Carex punctata*	Odd occurrence on heathy road verge		Nationally scarce		1
Grasslands	Vascular plant	*Chamaemelum nobile*	Neutral greens (MG6) and U1 and M24/25		Nationally scarce		1
Ephemeral ponds	Vascular plant	*Cicendia filiformis*	Shallow ephemeral ponds and scuffed turf		Nationally scarce		1
Parched acid grassland	Vascular plant	*Crassula tillaea*	Open patches in parched acid grasslands (U1)		Nationally scarce		1
Mire	Vascular plant	*Cyperus longus*	Clump in poor fen/wet heath		Nationally scarce		1
Ephemeral ponds	Vascular plant	*Deschampsia setacea*	Acid ephemeral ponds in wet heath		Nationally scarce		1
Permanent pond	Vascular plant	*Elatine hexandra*	*Littorelletalea* permanent ponds		Nationally scarce		1
Wet heath	Vascular plant	*Gentiana pneumonanthe*	Tussock heath (M16b)		Nationally scarce		1
Heathland	Vascular plant	*Gentianella anglica*	Imported chalk in heathland	Annex II	Nationally scarce	Yes	1
Mire	Vascular plant	*Hammarbya paludosa*	In M21a valley bogs		Nationally scarce		1
Parched acid grassland	Vascular plant	*Hypochaeris glabra*	Sandy parched acid grassland (U1b)		Nationally scarce		1
Ephemeral ponds	Vascular plant	*Illecebrum verticillatum*	Shallow ephemeral ponds		Nationally scarce		1
Ephemeral ponds	Vascular plant	*Limosella aquatica*	Nutrient enriched permanent ponds		Nationally scarce		1

Habitat	Group	Species	Requirements	European	National	IR	Status
Parched acid grassland	Vascular plant	*Lotus subbiflorus*	Parched acid grassland (U1f)		Nationally scarce		1
Ephemeral ponds	Vascular plant	*Luronium natans*	*Littorelletalea* ephemeral ponds	Annex II	Nationally scarce	Yes	1
Wet heath	Vascular plant	*Lycopodiella inundata*	Open wet heath (M16c)		Nationally scarce	Yes	1
Parched acid grassland	Vascular plant	*Marrubium vulgare*	A native looking site on green		Nationally scarce		1
Forestry Inclosure	Vascular plant	*Melittis melissophyllum*	Neutral woodland (W10b) and scrub		Nationally scarce		1
Ephemeral ponds	Vascular plant	*Ophioglossum azoricum*	Shallow ephemeral ponds		Nationally scarce		1
Heathland	Vascular plant	*Orobanche rapum-genistae*	Old gorse bushes in heathland		Nationally scarce		1
Ephemeral ponds	Vascular plant	*Pilularia globulifera*	*Littorelletalea* ephemeral ponds		Nationally scarce	Yes	1
Pasture woodland	Vascular plant	*Polygonatum odoratum*	Acid beech-oak wood (W14)		Nationally scarce		1
Waste ground	Vascular plant	*Polypogon monspeliensis*	Saltmarsh in polluted landfill drainage		Nationally scarce		1
Heathland and wood pasture	Vascular plant	*Pulmonaria longifolia*	Varied (M16b, U20, W14, W8b, W10b)		Nationally scarce		1
Wet heath	Vascular plant	*Rhynchospora fusca*	Open wet heath (M16c)		Nationally scarce		1
Alder moor	Vascular plant	*Thelypteris palustris*	Alder moors (W5)		Nationally scarce		1

Habitat	Group	Species	Requirements	European	National	IR	Status
Pasture woodland	Vascular plant	*Tilia platyphyllos*	Naturalised by seeding in from garden		Nationally scarce		x
Parched acid grassland	Vascular plant	*Trifolium glomeratum*	Parched acid grassland (U1f)		Nationally scarce		1
Heathland	Vascular plant	*Viola lactea*	Dry heath and heathy acid grassland (H3c, U3)		Nationally scarce		1
Parched acid grassland	Vascular plant	*Vulpia ciliata ssp. ambigua*	Open parched acid grassland (U1f)		Nationally scarce		1
Heathland	Vascular plant	*Juniperus communis*	Scrubby heath (H2 and H3)		Least concern	Yes	1

Totals

Status: 1 = recorded in last 50 years; 0 = no record in last 50 years.	National status	Recent	Extinct	Introduced
	Extinct	0	1	
	Endangered	1	0	
	Vulnerable	5	0	
	Near Threatened	5	0	
	Nationally scarce	30	0	1
	Totals	41	1	1

All the heathland species are, to varying degrees, dependant on the continuation of grazing for their survival. During the 20th century a loss of grazing on the nearby Dorset heaths caused a catastrophic decline of plant diversity on these heaths with ephemeral ponds and grasslands suffering the worst (Byfield and Pearman, 1996). More positively, in the last 20 years some extensive grazing systems have been restored on Dorset heaths.

The woodlands lack many species of national conservation concern but do have rich floras of characteristic species. Woodland plant diversity can be measured in terms of woodland indicator species and Dr F. Rose's Ancient Woodland Vascular Plant (AWVP) indicator lists for southern England (Rose, 1999) is the most relevant for the area. Out of 100 species, 78 have been recorded from the Crown Land woodlands and 71 from Roydon Wood. These are very high totals. In the Crown woods all but about three or four species have been found in the pasture woodlands. Much has been made of the supposed poverty of the pasture woodlands in woodland plants because of grazing. This is not backed up by the actual evidence and the overall floras of grazed and ungrazed woodlands are very similar when woods on similar soils are compared (Chatters and Sanderson, 1994). The frequency of individual species can, however, be very different.

Some plants do occur in Roydon and Langley Woods which are absent from the Crown Lands but these are mostly species typical of the London Clay which are absent in southwest Hampshire or occur rarely on some Headon Bed outcrops. These include *Carex strigosa*, *Daphne laureola*, *Neottia nidus-avis*, *Galium odoratum* and *Polygonatum multiflorum*. Grazing does not seem to be an important factor as the first three are known from pasture woodlands in Roydon Wood or Pitts Deep and all are largely absent or very rare in ancient coppices within the New Forest area.

New Forest bryophytes

Over the past 20 years further bryophyte surveys and associated records have been made. For further information, in the first instance contact Hampshire Biodiversity Information Centre. Furthermore, at the time of writing John Norton (Vice County recorder for the British Bryological Society) also maintains a dataset and accompanying maps (Hampshire and IOW Bryophytes).

No bryophyte species are Qualifying Features but the bryophyte assemblage within the New Forest SAC habitats is very diverse. There are about 1,030 species of bryophytes in Britain of which at least 326 have been recorded from the New Forest SAC (96 liverworts and 230 mosses), representing some 31% of the British flora (Paton, 1961; Crundwell and Rose, 1996). Of these, 33 are of conservation concern and have been recorded in the last 50 years. Four liverworts of conservation concern are known only from 19th century records. Of the recently recorded species, a third are woodland species and the rest are

heathland species. The most recent known survey was conducted in 2010 as part of a review of the status of New Forest SSSI interests (Callaghan, 2010) on behalf of Natural England. Following survey it was concluded that the two features assessed (*Zygodon forsteri* individually and the complete assemblage of rare/scarce species) are both in favourable condition. In general, the habitats important for sustaining the bryophyte feature of interest within the SSSI were being managed in a way which maintained their interest for these plants.

Bryophytes of conservation concern together with their habitat requirements and status are listed on Table 27.

The woodland species include two species associated with old trees, including the endangered *Zygodon forsteri* of particular international significance and several species of rotting logs and earth banks. This is a very small number compared the woodland lichens which illustrates the weaker link between bryophytes and old growth conditions. One species, the nationally scarce moss *Leucobryum juniperoideum*, is a major ground flora species in the acidic beech-oak pasture woodlands. It is highly dependent on grazing and is much rarer in ungrazed woods.

Table 27: New Forest bryophytes of conservation concern, habitat requirements and status. Key: BAP = Biodiversity Action Plan; IR: Introduced

Habitat	Group	Species	Requirements	European	National	BAP	IR	Status
Pasture woodland	Moss	*Zygodon forsteri*	Rain tracks on ancient beeches		Endangered	Yes		1
Transition mire	Moss	*Hamatocaulis vernicosus (sens. lat.)*	Slightly base-enriched mires	Annex II	Data Deficient			1
Pasture woodland	Moss	*Brachythecium salebrosum*	Rotting logs in damp woodland		Nationally Scarce			1
Heathland	Moss	*Bryum creberrimum*	Path in heathland		Nationally Scarce			1
Heathland	Moss	*Bryum intermedium*	Disturbed soil in heathland		Nationally Scarce			1
Heathland	Moss	*Bryum tenuisetum*	Bare acid soil		Nationally Scarce			1
Ephemeral pond	Moss	*Campylium elodes*	In marl pits and base-rich wet grassland		Nationally Scarce			1
Forestry Inclosure	Moss	*Campylopus subulatus*	Bare acid soil		Nationally Scarce			1
Heathland	Moss	*Dicranum polysetum*	Shaded heathland		Nationally Scarce			1
Humid heath	Moss	*Dicranum spurium*	Short sunny humid heath (H2c)		Nationally Scarce			1
Heathland	Moss	*Drepanocladus lycopodioides*	Base enriched wet heath or mire		Nationally Scarce			1
Ephemeral pond	Moss	*Drepanocladus sendtneri*	In marl pit		Nationally Scarce			1
Pasture woodland	Moss	*Herzogiella seligeri*	Rotting logs in woodland		Nationally Scarce			1
Wet heath	Moss	*Hypnum imponens*	Short sunny wet heath (H16a and M16b)		Nationally Scarce			1
Pasture	Moss	*Leptodon smithii*	Well-lit and base-rich old trees		Nationally Scarce			1

Habitat	Group	Species	Requirements	European	National	BAP	IR	Status
woodland								
Pasture woodland	Moss	*Leucobryum juniperoideum*	Acid beech-oak woods (W17/W14)		Nationally Scarce			1
Transition mire	Moss	*Philonotis caespitosa*	Slightly base-enriched marsh		Nationally Scarce			1
Parched acid grassland	Moss	*Racomitrium elongatum*	Acid grassland (U1)		Nationally Scarce			1
Bog woodland	Moss	*Sphagnum angustifolium*	Shaded area in bog woodland (W4)		Nationally Scarce			1
Wet Lawn	Moss	*Weissia microstoma var. brachycarpa*	Grassland in marl pits		Nationally Scarce			1

Totals				
Status: 1 = recorded in last 50 year; 0 = no record in last 50 years; x = Introduced	National status	Recent	Extinct	Introduced
	Endangered	1	0	0
	Data Deficient	1	0	0
	Nationally Scarce	18	0	0
	Total	20	0	0

Habitat	Group	Species	Requirements	European	National	BAP	IR	Status
Heathland	Liverwort	*Cephaloziella turneri*	Bare acid soil on banks		Vulnerable			0
Pasture woodland	Liverwort	*Pallavicinia lyellii*	Alder carr in riverine woodland		Vulnerable	Yes		1
Ephemeral ponds	Liverwort	*Fossombronia maritima*	Shallow ephemeral ponds		Near Threatened			1
Heathland	Liverwort	*Lophozia capitata*	Bare and damp acid soil		Near Threatened			0
Wet lawn	Liverwort	*Anthoceros punctatus*	Marly clay on wet lawn and		Nationally Scarce			1

Habitat	Group	Species	Requirements	European	National	BAP	IR	Status
			streamside					
Pasture woodland	Liverwort	*Cephalozia catenulata*	Rotting logs		Nationally Scarce			1
Mire	Liverwort	*Cephalozia macrostachya*	Epiphytic on *Sphagnum* in valley bogs (M21a)		Nationally Scarce			1
Mire	Liverwort	*Cephalozia pleniceps*	Epiphytic on *Sphagnum* in valley bogs (M21a)		Nationally Scarce			1
Mire	Liverwort	*Cephaloziella elachista*	Epiphytic on *Sphagnum* in valley bogs (M21a)		Nationally Scarce			1
Heathland	Liverwort	*Cladopodiella francisci*	Moist bare peat in wet heath (M16a and M16c)		Nationally Scarce			1
Pasture woodland	Liverwort	*Cololejeunea minutissima*	Base-rich bark of shrubs		Nationally Scarce			1
Ephemeral ponds	Liverwort	*Fossombronia foveolata*	Shallow ephemeral ponds		Nationally Scarce			1
Parched acid grassland	Liverwort	*Fossombronia incurva*	Bare soil in acid grassland (U1)		Nationally Scarce			1
Pasture woodland	Liverwort	*Kurzia sylvatica*	Shaded banks of acid soil		Nationally Scarce			1
Parched acid grassland	Liverwort	*Riccia subbifurca*	Bare soil in acid grassland (U1)		Nationally Scarce			1
Parched acid grassland	Liverwort	*Sphaerocarpos michelii*	Bare soil in acid grassland (U1)		Nationally Scarce			0
Heathland	Liverwort	*Targionia hypophylla*	Sandy banks of hollow lanes (U1)		Nationally Scarce			0

Habitat	Group	Species	Requirements	European	National	BAP	IR	Status
Totals								

Status: 1 = recorded in last 50 year; 0 = no record in last 50 years; x = Introduced	National status	Recent	Extinct	Introduced
	Vulnerable	1	1	0
	Near Threatened	1	1	0
	Nationally Scarce	11	2	0
	Total	13	4	0

The heathland species are found in a wide range of habitats. Two species of particular importance are the nationally scarce mosses *Hypnum imponens* and *Dicranum spurium*. These are light demanding species that share heavily grazed humid and drier wet heath with rich lichen floras. Both species have had serious collapses in their populations and declines in distributions beyond the New Forest. The New Forest now probably supports the majority of the English populations of these species.

Another distinctive group are the tiny liverworts that are epiphytic on *Sphagnum* in valley bogs. These include the nationally scarce *Cephalozia macrostachya macrostachya*, *Cephalozia pleniceps* and *Cephaloziella elachista*. This epiphytic liverwort flora, including other less threatened species, is otherwise only found in undamaged blanket and raised bogs.

Another major group is annual species of liverwort of ephemeral ponds and bare seasonally wet soils that includes the nationally scarce *Fossombronia foveolata*, *Fossombronia incurva*, *Riccia subbifurca* and *Sphaerocarpos michelii*. Deeper, more base-enriched ephemeral ponds in marl pits also support a rich moss flora related to that of alkaline fens that includes the nationally scarce species *Drepanocladus sendtneri* and *Campylium elodes*. The latter flora is highly threatened by scrub invasion. Two species associated with the transition mires in the Holmsley area, *Philonotis caespitosa* and *Hamatocaulis* (*Drepanocladus*) *vernicosus*, may have been lost to the spread of scrub. The latter is an Annex II species.

Only two species have been found in Roydon Wood but not on the Crown Lands and Adjacent Commons and otherwise all other species of conservation concern in the SAC appear to be found within the Crown Lands and other commons.

The full importance of the New Forest bryophyte flora, however, is not expressed by simply looking at the species of conservation concern. A major feature of the New Forest is the presence of many species that are otherwise rare or absent in the lowlands. Some of these disjunctions are very marked—for example *Thuidium delicatulum* is common on sloping wet lawns on clay (M24a and M16b) in the New Forest but is otherwise totally absent from lowland Britain. Concentrations of such species are found particularly in transition mires and in the pasture woodlands. The former include species such as *Sphagnum teres*, *Sphagnum contortum* and *Sphagnum subsecundum*; and the latter, quite a few Atlantic bryophytes including *Saccogyna viticulosa*, *Plagiochila killarniensis*, *Bazzania trilobata*, *Frullania fragilifolia*, *Harpalejeunea ovata* and *Hyocomium armoricum*. Other examples are the liverwort *Preissia quadrata* in alkaline fen at Stony Moors and *Splachnum ampullaceum* on pony and cattle dung in wet heath and mires.

The bryophyte flora of the SAC is the richest in lowland Britain and clearly of national

importance. The species of interest are all highly dependent on grazing to suppress competing vascular plant vegetation both in the heaths and the woods. *Splachnum ampullaceum* also depends on large herbivore dung being deposited within wet heaths and mires and has been lost from all other lowland localities. Scrub, both sallow in mires and marl pits and holly in the pasture woodlands is a clear threat to several species.

New Forest fungi

Over the past 20 years further fungi surveys and associated records have been made. For further information, in the first instance contact Hampshire Biodiversity Information Centre.

No fungi species are Qualifying Features of the New Forest SAC but the woodlands support an outstanding assemblage of rare and scarce fungi with the heathland also supporting some notable species. The following account excludes lichens and associated fungi. The ephemeral nature of most fungi fruiting bodies makes the recording of fungi especially difficult and the task of determining conservation status even harder. There has, however, been a century and a half of fungi recording in the New Forest area with much effort in recent decades. This has been summarised in Dickson and Leonard (1996). The number of species recorded is not given but appears to be about 2,500 non-lichenised fungi. This mycota covers a wider area than the SAC and does not cover Wiltshire, but most species were recorded from the SAC. Draft RDB lists have been produced for both Europe and Britain and Dickson et al (1996) have analysed the New Forest mycota (Dickson and Leonard, 1996). Additional data is provided in Wicks (1999) and Ewald (2000).

These sources indicate that at least 89 fungi of conservation concern have been recorded from the SAC, of which 18 have not been seen in the last 50 years. Of the species of nature conservation concern most are woodland species, with only nine heathland and grassland species recorded. These include species of acid grassland and species that are mycorrhizal on *Salix repens*. The best-known heathland species is *Poronia punctata*, which is a specialist confined to dung from horses grazing acidic rough pastures. It is found on dung deposited on acid grassland and heath and is possibly now confined to the New Forest in Europe. Fungi of conservation concern together with their habitat requirements and status are listed on Table 28.

The 71 woodland species include a group of 11 species confined to old trees, or fallen large trees, within the pasture woodlands. These include the toothed fungi *Hericium cirrhatus*, *Hericium coralloides*, *Hericium erinaceum* and the bracket fungi *Phellinus robustus*. These are clearly old growth dependent species and have very low population densities (Wicks, 1999). They are only ever found on tiny numbers of old trees in a pasture woodland complex with approximately 250,000 old trees. Many epiphytic lichens exhibit a similar restriction to tiny numbers of trees and suggests very large areas of pasture woodland are

required to support such old growth dependent species.

The rest of the woodland fungi are ground growing species, mainly mycorrhizal on trees, but including some saprophytes. The majority, 58, have been recorded within the pasture woodlands but some of these have also been noted in the older broadleaved stands in the Inclosures. Eight have only been recorded within the Inclosures. These include a few native species that have only been rarely recorded and their absence from the pasture woodlands may just be chance. Others are symbiotic or parasitic on conifers and are therefore recent arrivals of low conservation concern. Similarly, but of greater interest, are several species characteristic of native pinewoods that have turned up on pine on the Open Forest e.g., *Rozites caperatus* and *Sarodon squamosus*. These species must also be recent arrivals but grow in conditions that resemble the pasture woodland conditions found in old growth native pinewoods. They are, therefore, not likely to be found in pine plantations. They are still not of high nature conservation concern but are a factor to be considered. The native floras are richest in woods on damp clay-based soils, often with some local base enrichment.

Table 28: New Forest fungi of conservation concern: habitat requirements and status. Key: BAP = Biodiversity Action Plan; IR: Introduced

Habitat	Group	Species	Requirements	European	National	BAP	IR	Status
Pasture woodland	Fungi	*Boletus regius*	Mycorrhizal on oak on clay	End. A	Endangered	Yes		1
Acid grassland	Fungi	*Entoloma bloxami*	Grassy glades	End. B	Endangered			1
Pasture woodland	Fungi	*Hydnellum scrobiculatum*	Mycorrhizal on pine, not native and not seen recently	End. B	Endangered	Yes		1
Pasture woodland, trees	Fungi	*Lentinellus urinus*	Very old logs and stumps of beech	End. C	Endangered			1
Pasture woodland	Fungi	*Phellodon confluens*	Mycorrhizal on oak on clay, on banks	End. A	Endangered	Yes		1
Forestry Inclosure	Fungi	*Phellodon tomentosus*	Single 19th century occurrence on pine	End. B	Endangered	Yes		0
Woodland	Myxomycete	*Physarum didermoides*	No habitat data		Endangered			0
Woodland	Myxomycete	*Physarum straminipes*	No habitat data		Endangered			0
Pasture woodland	Fungi	*Pisolithus arhizus*	Mycorrhizal on pine	End. C	Endangered			0
Pasture woodland, trees	Fungi	*Polyporus umbellatus*	Dead birch and oak roots	End. B	Endangered			1
Heathland	Fungi	*Poronia punctata*	Pony dung on grassland and heath	End. A	Endangered	Yes		1
Pasture woodland	Fungi	*Pulveroboletus gentilis*	Mycorrhizal on oak, in grass	End. B	Endangered			1
Forestry Inclosure	Fungi	*Pulveroboletus lignicola*	Douglas fir plantations	End. B	Endangered			1
Forestry Inclosure	Fungi	*Ramariopsis puchella*	Unknown	End. C	Endangered			1
Pasture woodland	Fungi	*Sarcodon scabrosus*	Under broadleaved trees	End. B	Endangered	Yes		1
Forestry Inclosure	Fungi	*Sparassis laminosa*	On dead roots of old beeches	End. C	Endangered			1
Pasture woodland	Fungi	*Suillus flavidus*	Mycorrhizal on pine in *Sphagnum*	End. B	Endangered			0
Pasture woodland	Fungi	*Boletus junuilleus*	Mycorrhizal on oak on clay in grassy	End. A	Vulnerable			1

Habitat	Group	Species	Requirements	European	National	BAP	IR	Status
			glades					
Pasture woodland	Fungi	*Boletus purpureus*	Mycorrhizal on oak in grassy glades and litter		Vulnerable			1
Pasture woodland	Fungi	*Cantharellus cinereus*	Closed canopy beech stands	End. C	Vulnerable			1
Pasture woodland	Fungi	*Cantharellus lutescens*	Closed canopy beech stands		Vulnerable			1
Pasture woodland	Fungi	*Cortinarius balteautocumatilis*	Mycorrhizal on oak on clay		Vulnerable			1
Pasture woodland	Fungi	*Cortinarius caerulescens*	Mycorrhizal on broadleaves		Vulnerable			0
Pasture woodland	Fungi	*Cortinarius cumatilis*	Mycorrhizal on broadleaves		Vulnerable			0
Pasture woodland	Fungi	*Cortinarius durus*	Riverine woodland		Vulnerable			1
Pasture woodland	Fungi	*Cortinarius fulgens*	Mycorrhizal on oak		Vulnerable			0
Pasture woodland	Fungi	*Cortinarius glaucopus*	Mycorrhizal on broadleaves on clay		Vulnerable			1
Pasture woodland	Fungi	*Cortinarius infractus*	Mycorrhizal on oak on clay		Vulnerable			1
Pasture woodland	Fungi	*Cortinarius multiformis*	Mycorrhizal on beech in grassy pasture woodland		Vulnerable			0
Pasture woodland	Fungi	*Cortinarius olidus*	Mycorrhizal on oak		Vulnerable			1
Pasture woodland	Fungi	*Cortinarius orichalceus*	Mycorrhizal on oak		Vulnerable			0
Pasture woodland	Fungi	*Cortinarius parvus*	Mycorrhizal on beech and possibly oak		Vulnerable			1
Pasture woodland	Fungi	*Cortinarius sebaceus*	Mycorrhizal on oak	End. C	Vulnerable			1
Pasture woodland	Fungi	*Cortinarius subpurpurascens*	Mycorrhizal on beech and oak		Vulnerable			1
Pasture woodland	Fungi	*Cortinarius subtortus*	In *Sphagnum* but mycorrhizal on trees		Vulnerable			1
Forestry Inclosure	Fungi	*Cortinarius variicolor*	Mycorrhizal on broadleaves?		Vulnerable			0
Pasture woodland	Fungi	*Cortinarius varius*	Mycorrhizal on oak		Vulnerable			0

Habitat	Group	Species	Requirements	European	National	BAP	IR	Status
Pasture woodland	Fungi	*Cortinarius xanthophyllus*	Mycorrhizal on oak on clay		Vulnerable			1
Pasture woodland, trees	Fungi	*Hericium cirrhatus*	Standing of fallen beech dead wood		Vulnerable			1
Pasture woodland, trees	Fungi	*Hericium coralloides*	Fallen beech trunks		Vulnerable			1
Pasture woodland, trees	Fungi	*Hericium erinaceum*	Knot holes in ancient beeches	End. B	Vulnerable	Yes		1
Pasture woodland	Fungi	*Hydnellum concrescens*	Mycorrhizal on oak on clay, on banks		Vulnerable	Yes		1
Acid grassland	Fungi	*Hygrocybe calyptraeformis*	Short grassland		Vulnerable	Yes		0
Pasture woodland	Fungi	*Hygrophorus arbustivus*	Mycorrhizal on oak on clay, in leaf litter	End. C	Vulnerable			1
Pasture woodland	Fungi	*Lactarius hemicyaneus*	Mycorrhizal on pine, in pasture woodland		Vulnerable			1
Heathland	Fungi	*Leccinum salicola*	Mycorrhizal on creeping willow, M16b		Vulnerable			1
Forestry Inclosure	Fungi	*Lepiota georginae*	Leaf litter of Douglas fir		Vulnerable			1
Woodland	Fungi	*Leucoagaricus badhamii*	No habitat data		Vulnerable			1
Acid grassland	Fungi	*Microglossum olivaceum*	Short unimproved grasslands	End. B	Vulnerable	Yes		1
Forestry Inclosure	Fungi	*Mycena rubromarginata*	Conifer needles		Vulnerable			1
Pasture woodland	Fungi	*Mycocalia sphagneti*	Various leaves		Vulnerable			1
Pasture woodland	Fungi	*Naucoria scolecina*	Mycorrhizal on alder, in riverine woodland		Vulnerable			1
Pasture woodland	Fungi	*Phellodon melaleucus*	Mycorrhizal on oak on clay, on	End. C	Vulnerable	Yes		1

Habitat	Group	Species	Requirements	European	National	BAP	IR	Status
			banks					
Pasture woodland	Myxomycete	*Physarum psittacinum*	Damp wood and vegetation in woodland		Vulnerable			1
Pasture woodland, trees	Fungi	*Pluteus pellitus*	Well decayed beech wood		Vulnerable			1
Pasture woodland	Fungi	*Pseudocraterellus sinuosus*	Mycorrhizal on birch		Vulnerable			1
Pasture woodland	Fungi	*Rozites caperatus*	Under oak and pine		Vulnerable			1
Pasture woodland	Fungi	*Russula azurea*	Below beech	End.	Vulnerable			0
Pasture woodland	Fungi	*Russula carminea*	Below oak	End.	Vulnerable			1
Pasture woodland	Fungi	*Russula solaris*	Below beech	End.	Vulnerable			1
Pasture woodland	Fungi	*Sarodon squamosus*	Mycorrhizal on pine by stream	End. C	Vulnerable	Yes		1
Forestry Inclosure	Fungi	*Spathularia flava*	In larch plantation	End. B	Vulnerable			1
Pasture woodland	Fungi	*Strobilomyces strobilaceus*	Under oak in bracken	End.	Vulnerable			1
Pasture woodland	Fungi	*Tricholoma acerbum*	Under oak and pine	End. B	Vulnerable			1
Pasture woodland	Fungi	*Tricholoma atrosquamosum*	Under oak in pasture woodland	End.	Vulnerable			1
Pasture woodland, trees	Fungi	*Aurantioporus alborubes*	Trunks of old beech trees		Rare			1
Pasture woodland	Fungi	*Boletus leonis*	Mycorrhizal on oak on clay		Rare			1
Pasture woodland	Fungi	*Boletus satanas*	Mycorrhizal on oak on base-rich clay	End. A	Rare	Yes		1
Pasture woodland	Fungi	*Chlorencoelia versiformis*	Dead wood of ash, oak and willow		Rare			0
Pasture woodland	Fungi	*Collybia racemosa*	Mixed woodland on clay		Rare			1
Pasture	Fungi	*Hohenbeuhelia*	Fallen beech trunks		Rare			1

Habitat	Group	Species	Requirements	European	National	BAP	IR	Status
woodland, trees		*mastrucata*						
Pasture woodland	Fungi	*Hydnellum spongiosipes*	Mycorrhizal on oak on clay, on banks		Rare	Yes		1
Pasture woodland	Fungi	*Marasmuis hudsonii*	Fallen holly leaves	End. C	Rare			1
Pasture woodland, trees	Fungi	*Phellinus robustus*	Bracket fungus on old oak		Rare			1
Pasture woodland	Fungi	*Phellodon niger*	Mycorrhizal on oak on clay, on banks	End. B	Rare			1
Heathland	Fungi	*Puccinia betonicae*	Parasitic on *Stachys officinalis*		Rare			0
Pasture woodland	Fungi	*Russula amarissima*	In oak-beech pasture woodland	End.	Rare			1
Pasture woodland	Fungi	*Russula aurata*	Underneath oak	End.	Rare			1
Heathland	Fungi	*Russula persicina*	Mycorrhizal on creeping willow, M16b	End.	Rare			1
Pasture woodland	Fungi	*Russula pumila*	Below alder riverine woodland	End. B	Rare			1
Pasture woodland, trees	Fungi	*Spongipellis delectans*	Fallen old beeches		Rare			1
Pasture woodland, trees	Fungi	*Spongipellis pachyodon*	Fallen old beeches		Rare			1
Pasture woodland	Fungi	*Boletus fechtneri*	Mycorrhizal on oak on clay	End. B				1
Pasture woodland	Fungi	*Boletus impolitus*	Mycorrhizal on oak on clay	End. B				1
Pasture woodland	Fungi	*Boletus queletii*	Mycorrhizal on oak on clay	End. B				1
Pasture woodland	Fungi	*Boletus torosus*	Mycorrhizal on oak in grassy glades and litter	End. D				1
Acid grassland	Fungi	*Camarophyllus lacmus*	Acid grassland	End. B				0
Pasture woodland	Fungi	*Clavaria zollingeri*	Grass under birch	End. C				0
Heathland	Fungi	*Xerocomus armenaicus*	Wet lawn, possible on creeping		First British			1

Habitat	Group	Species	Requirements	European	National	BAP	IR	Status
			willow		Record			

Totals:				
Status: 1 = recorded in last 50 years; 0 = no record in last 50 years; x = Introduced	National Status	Recent	Extinct	Introduced
	Endangered	12	5	0
	Vulnerable	39	9	0
	Rare	15	2	
	Endangered in Europe/Least Concern in Britain	4	2	
	First British record	1	0	0
	Total	71	18	0

A group of particular interest is the toothed hydnoid fungi including *Hydnellum concrescens*, *Hydnellum spongiosipes*, *Phellodon niger*, *Phellodon confluens*, *Phellodon melaleucus* and *Sarcodon scabrosus* (Ewald, 2000). These are curiously distributed with concentrations in major pasture woodland complexes such as the New Forest and the Speyside native pinewoods and former pasture woodlands as at Windsor Forest and are a group of particular conservation concern. Woods of beech and oak, with a varied structure, including both glades and groves are richest. Extensive grazing in the pasture woodlands is also probably important. Experiments in the Netherlands have indicated that extensive grazing promotes fungi diversity within woods as measured by numbers of fruiting species and numbers of fruit (Keizier, 1993). As well as dung species arriving, the numbers of other groups are also increased greatly. This appears to be related to the removal of vegetation; fungal fruiting diversity is higher in short swards. The consumption of loose litter and direct compaction of litter may also be significant. Fungal diversity is much higher in soils dominated by hard compacted humus than those with very thick litter layer (Baar and Kuyper, 1993).

The fungal diversity of the New Forest is clearly high and a large number of species of conservation concern have been recorded and on present evidence the woodlands are of international significance.

Threats to the conservation of mycota are difficult to establish due to their poorly understood ecology. Habitat continuity is clearly vital and in the New Forest implies maintaining the pasture woodlands in a little disturbed but dynamic condition. This can be seen in possible declines in specific species being attributed to the opening up of beech canopies in Denny Wood but conversely to the loss of grassy glades Whitely Wood by the infilling of parkland like stands by regeneration (Dickson and Leonard, 1996). The generation of both dense groves and grassy glades is required to maintain a suitable range of habitats. In grasslands short swards and lack of sward improvement are vital to fungal conservation.

Specific possible threats mentioned by Dickson and Leonard (1996) include past drainage within woodlands drying out soils, collection of fruiting bodies, atmospheric pollution and human trampling. Of these, only the collection of fruiting bodies and atmospheric pollution are likely to currently be widespread serious threats.

Pollution effects are difficult to prove and may be confused by changes caused by modifications to woodland management and ecology unrelated to pollution. There appears to be no discernible effect from sulphur dioxide pollution. There are many polluted areas beyond the New Forest, sterilised of their lichen flora by sulphur dioxide pollution, that are still rich sites for fungi. More credible could be low level nitrogen pollution, which could interfere with the interaction between mycorrhizal fungi and their partner trees.

The possible effects of collecting are controversial—and as Dickson and Leonard (1996)

point out, there is no evidence that collecting for culinary purposes threatens the survival of fungi species. Positive effects may also accrue in greater public interest in fungi and their conservation. Many amateur mycologists start their interest in fungi though collecting for culinary use. More pertinent to the conservation of the biodiversity of the SAC is that the more ephemeral fruiting bodies are an important habitat for rare insects. There is now an agreed code for the Crown Lands, Adjacent Commons and Roydon Wood. Commercial harvesting is not permitted and foray leaders must obtain a licence. For the public, the request is to “Please look, but don’t pick”.

Cultural factors

Natural England uses National Character Areas to define areas that share similar landscape characteristics and which follow natural lines in the landscape rather than administrative boundaries, making them a good decision-making framework for the natural environment. Such areas are often shaped by common cultural factors, of which the New Forest is an excellent example (National Character Area 131: New Forest). The New Forest National Parks’ Landscape Character Assessment provides a more detailed assessment of the landscape of the New Forest. Further background on the following cultural factors can be found at Annex A to this document:

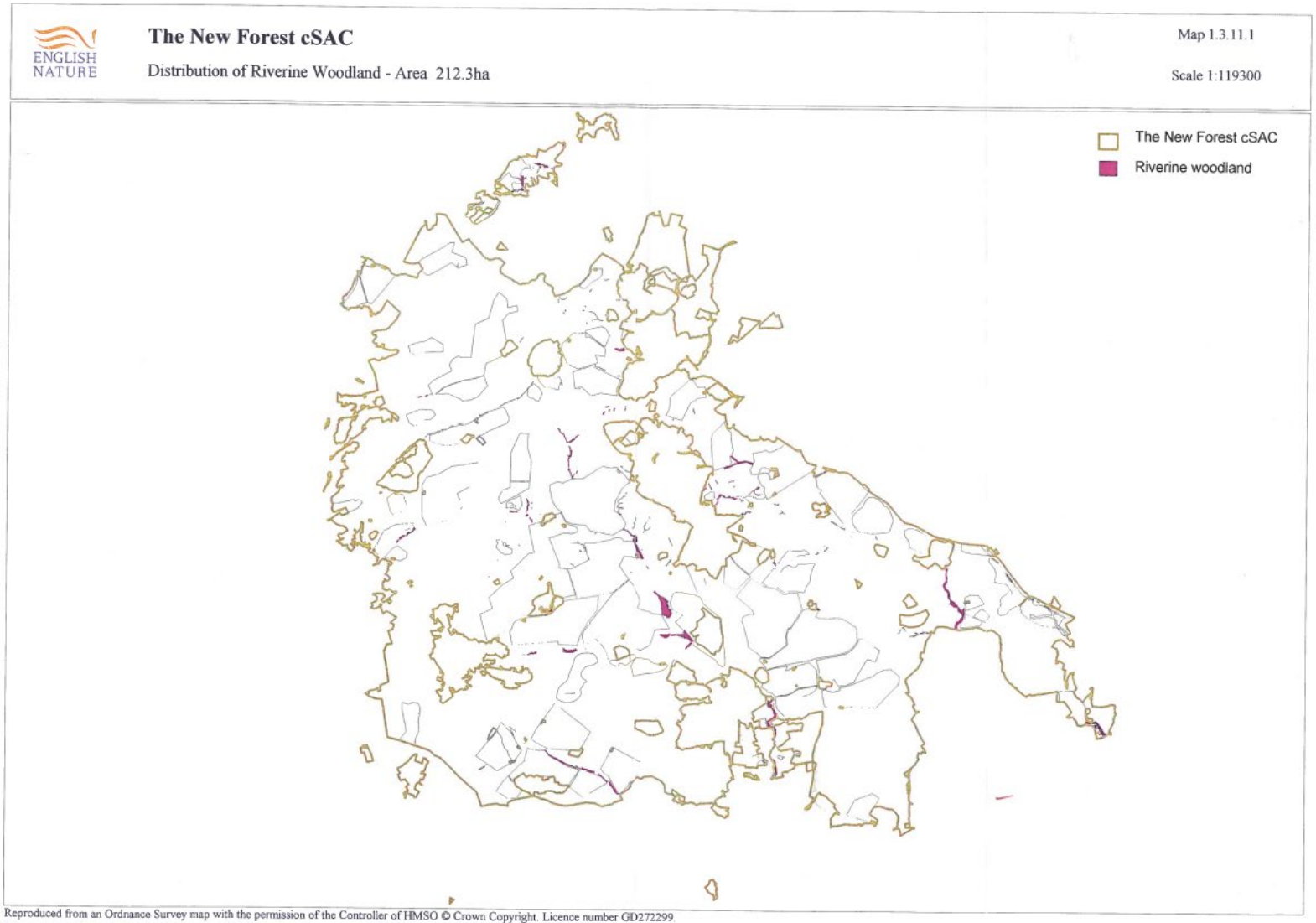
- Land use history of the Crown Lands and the wider SAC
- Commoning
- Access and Recreation

Maps of vegetation communities

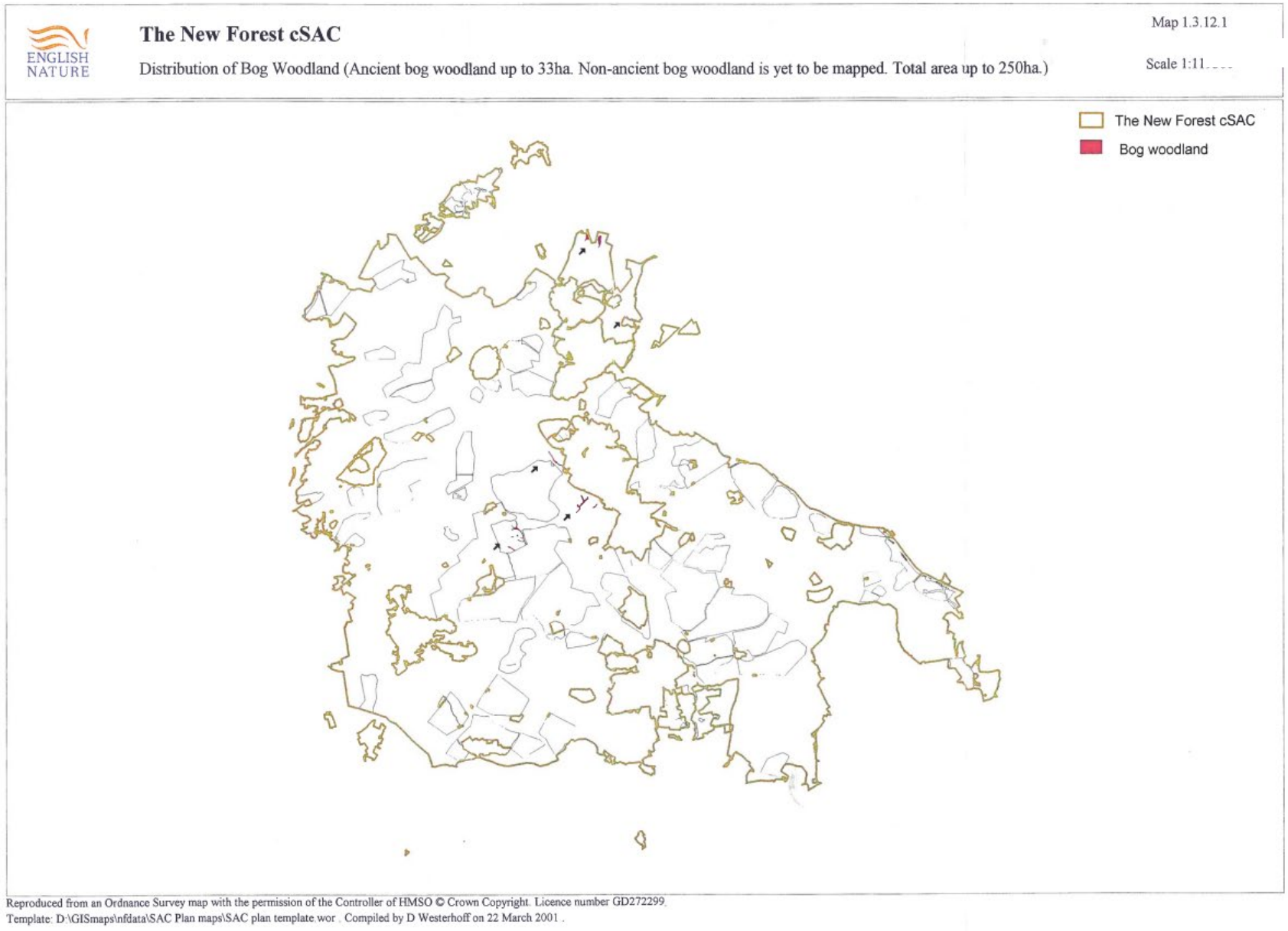
The maps in this section are scanned reproductions of the original SAC Plan maps of New Forest vegetation communities (2001), presented in the following order:

1. Riverine woodland
2. Bog woodland
3. Inclosure woodland
4. Dry heath
5. Wet heath
6. Valley mire
7. Dry grassland
8. Wet grassland

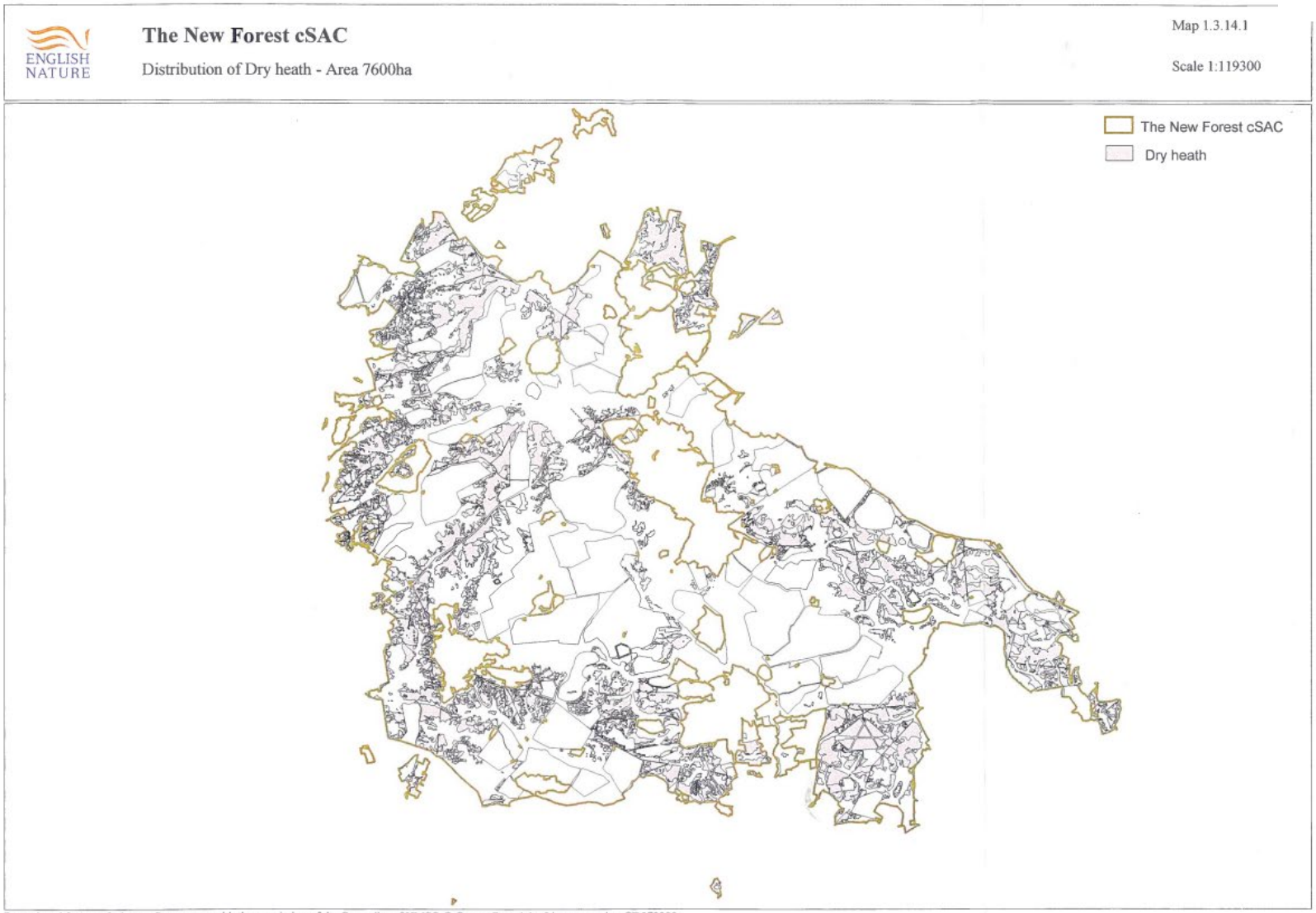
Map 2: Distribution of bog woodland



Map 3: Distribution of Inclosure woodland

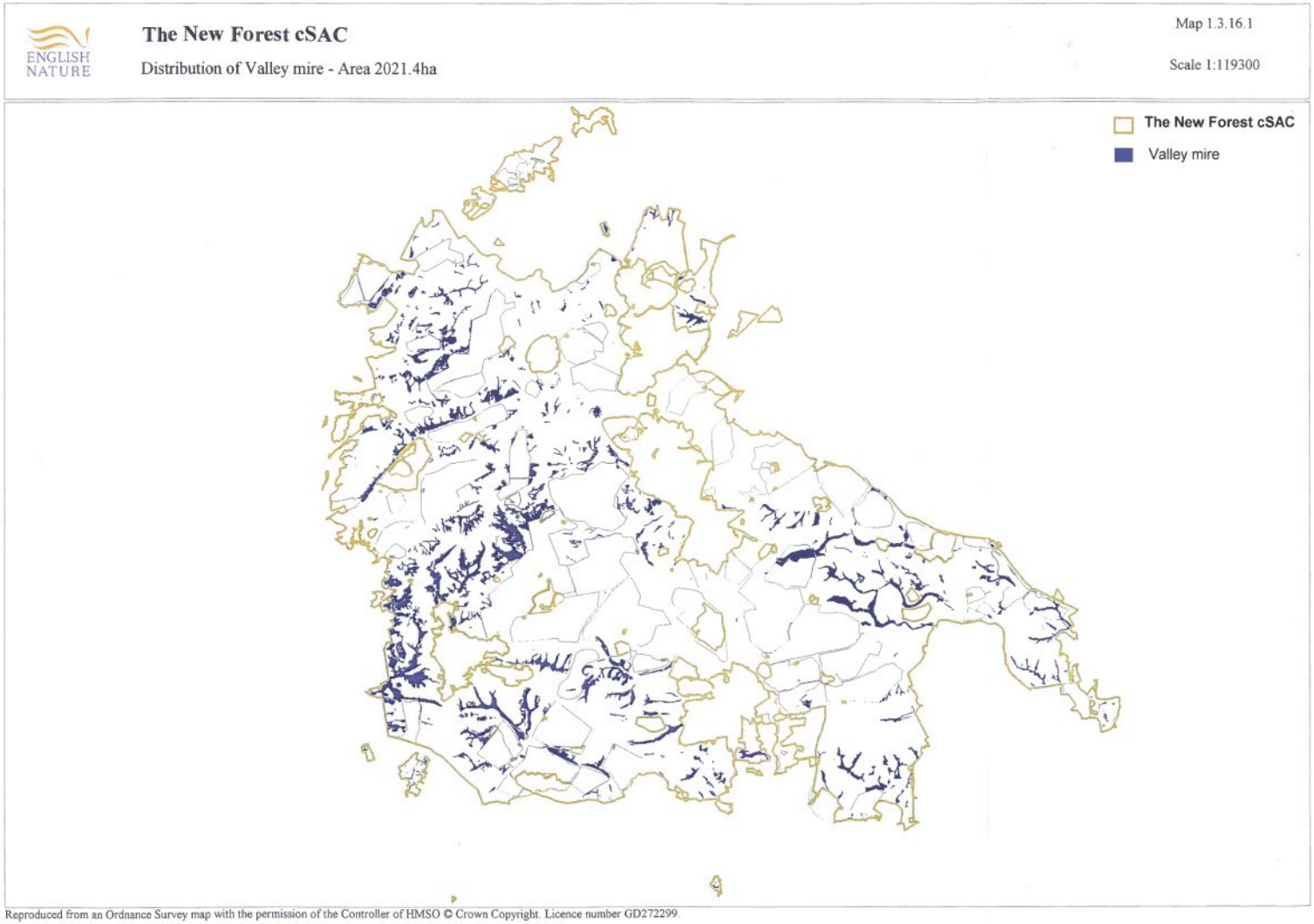


Map 4: Distribution of dry heath

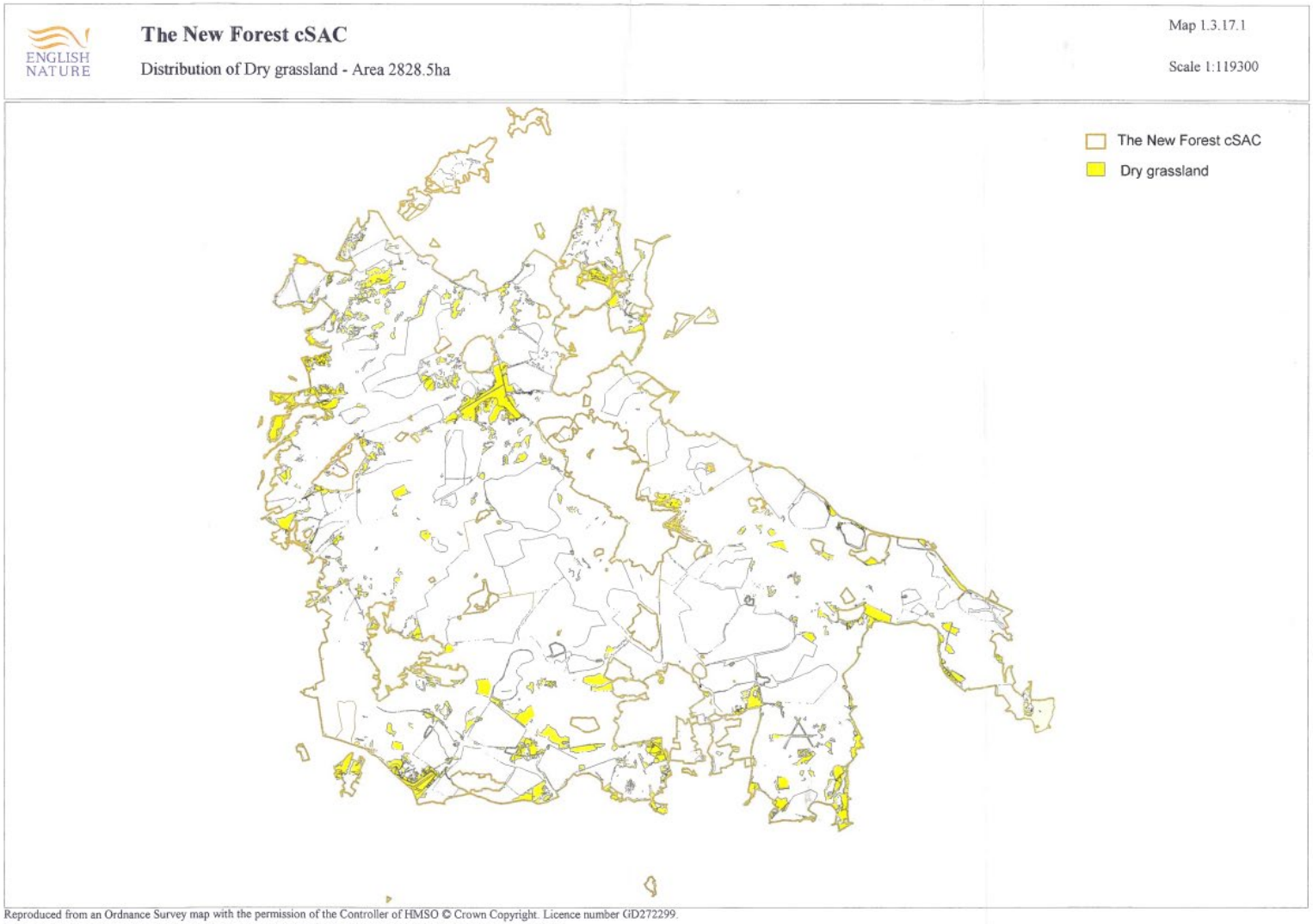


Map 5: Distribution of wet heath

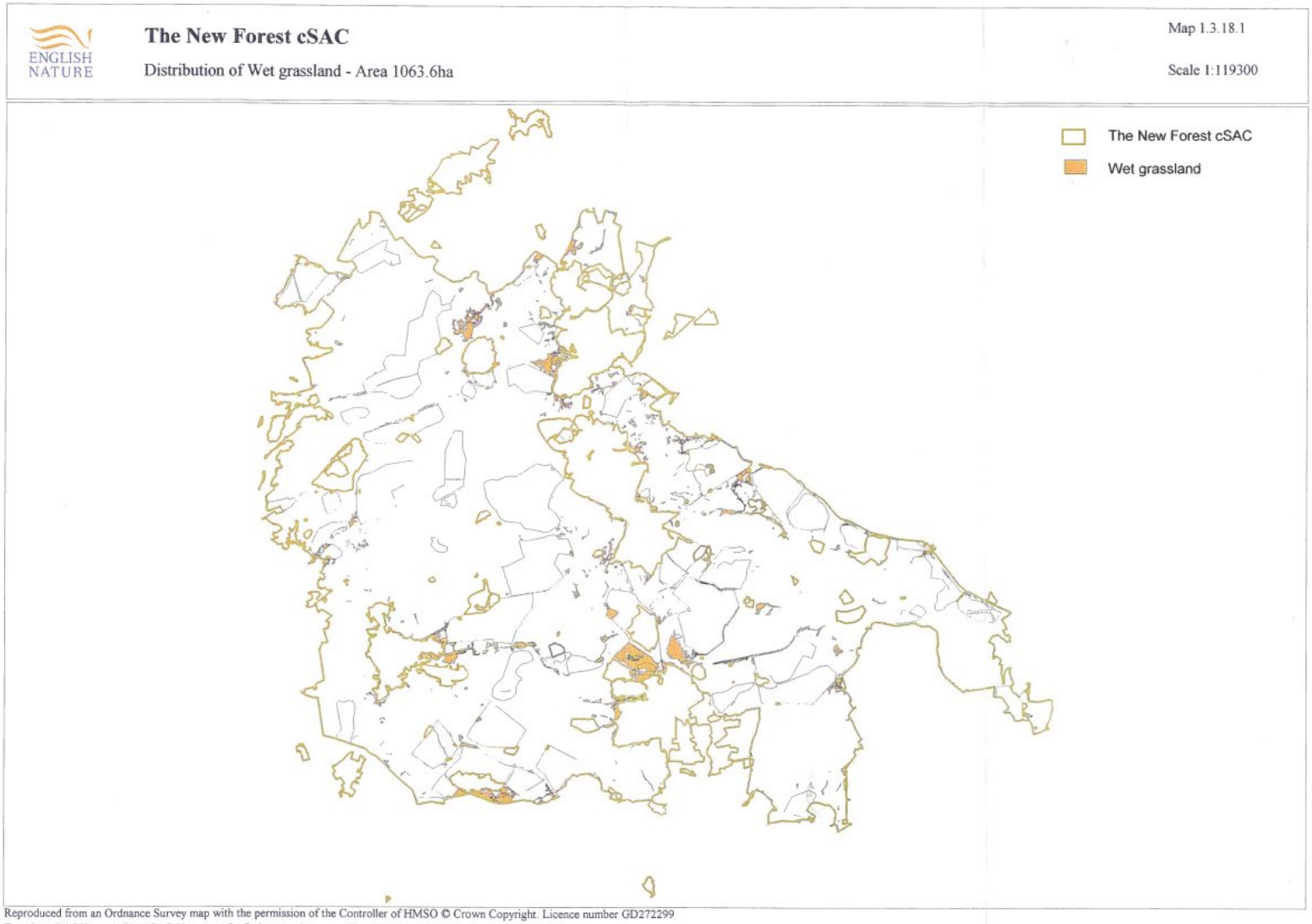
Map 6: Distribution of valley mire



Map 7: Distribution of dry grassland



Map 8: Distribution of wet grassland



NATURAL ENGLAND

www.gov.uk/natural-england