

New Forest Freshwater and wetland restoration plan:

Section 3 - Habitat descriptions

- 1.1 New Forest freshwater and wetland habitats, although of international importance, often do not conform to existing descriptions of the priority habitats¹ or Annex I habitats² to which they can be ascribed. The following sections describe quintessential New Forest freshwater and wetland habitat at their best that can be used to inform assessments of restored habitats.
- 1.2 The descriptions are based work by Neil Sanderson for Natural England on behalf of the New Forest Freshwater and Wetland Restoration Forum. The habitats are grouped under three headings: Peat Bog, Stream and River, and Floodplain. National Vegetation Classification (NVC) codes (Rodwell, 2006) are added in brackets after the first mention of described vegetation communities. A table is provided in Annex I indicating corresponding Annex I habitats and European Red Listed habitat for the main communities. All photos are by Neil Sanderson unless credited otherwise.

Peat bogs

Introduction

- 1.3 The extensive spring-fed mire systems of the New Forest are unique in their extent and quality in lowland England and western Europe (Tubbs, 2001). These mires (known locally as bogs) are found where there is not a well-defined central stream and the soil remains wet year-round, allowing peat to develop. They are highly complex in terms of their hydrology and vegetation. They vary according to the location of the springs, the characteristics of the water and grazing intensity.

¹ i.e. habitats of principle importance in England that are listed under Section 41 of the Natural Environment and Rural Communities Act (2006)

² i.e. habitats of European importance for which Special Areas of Conservation are designated under the Habitats Directive (1992) (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora)



Valley Bogs are groundwater-fed peat-forming bogs with Bog-moss lawns and bog plants such as Bog Asphodel and White Beak-sedge. Includes valley mires and seepage step mires.



Bog Pools are an integral part of Valley Bog and are characterised by mats of Bog-mosses floating in peaty water. They may be natural features or in some cases are flooded old peat workings.



Soakways are shallow, well-grazed flow lines at the drier edges of valley mires where they grade into Wet Lawns. Marsh St. John's-wort and Bog Pondweed are typical species.



Poached and Disturbed Habitat is found where livestock trample the soft peaty edges of mires support an assemblage including the rare Pillwort, Lesser Marshwort and Floating Club-rush.



Poor Fen is similar to Valley Bog and is found where the water is acid but higher in nutrients, for example where the catchment is wooded. Typical herbs include Marsh Willowherb and Bedstraw



Moor-grass Mire is found in valley mires where the movement of water and limited grazing facilitate vigorous growth of Purple Moor-grass. It is tall, tussocky and species-poor.



Marl Flushes are found where strongly calcareous water emerges, typically in step mires. They are species-rich and support typical "brown moss" species, small sedges and herbs.



Transition Mire is an unusual habitat found where the water chemistry unstable, with calcareous input into an otherwise acid system. Generally very wet, swampy stands support taller sedges while flushed stand have small sedges and herbs.



Tussock Sedge Fen was probably once locally associated with working Alder coppices in the south but has been lost to recent woodland. It has been restored during conservation work in the Holmsley area.



Bog Woodland is found where trees co-exists in equilibrium with mire species. Tree cover is limited by the high water table and low nutrient levels, in contrast to secondary woodland that develops on modified mires and leads to the loss of bog vegetation.

- 1.4 Spring lines along valley sides produce long, linear hanging mires strung out along valley sides or terrace edges, known as seepage step mires. These have shallow strongly flushed peats or humic gleys, and are mostly easily accessible to grazing livestock. Where the springs arise in valley bottoms, larger mires with deeper peat develop; they are usually known as valley mires and their wetness makes them less accessible to grazing animals.
- 1.5 The character of bog vegetation is determined largely by interactions between wetness, water chemistry, and grazing intensity (discussed below). It varies from extensive stands of single vegetation types to complex mosaics (including small stands of rare vegetation types that are important for species diversity). Transitional vegetation that does not match described vegetation communities are frequent. The main vegetation types (N. A. Sanderson, 1998) are:
- Valley Bogs
 - Bog Pools
 - Soakways
 - Poached and disturbed habitat
 - Poor Fen
 - Moor-grass Mires
 - Marl Flushes
 - Transition Mires
 - Tussock Sedge Fen
 - Bog Woodland
 - Alder Moors
- 1.6 Wet heath is found in transitions between bog vegetation and drier heathland and grassland. Also found at the peripheries of floodplain lawns, it is not technically a wetland habitat and is described in a separate section below.
- 1.7 The New Forest peat bogs are exceptionally rich in rare and declining species, particularly invertebrates, although vascular plants and wading bird populations are also nationally important, and bryophytes regionally so.

Geology and soils

- 1.8 Within the New Forest, the geological features that result in spring lines including Poole Formation/Selesy Sand Formation and Barton Clay/Chama Sand Deposits, with the latter producing a major spring line across the centre of the Forest. Significant spring lines are also produced by clays under plateau gravel, especially Barton Clay/River Terrace Deposits and Headon Beds/River Terrace Deposits and by thin, unmapped clay bands. Spring lines

on valley sides are typically better developed on one side than the other, presumably reflecting the dip of the impervious layer.

- 1.9 Mires generally have a peaty humus surface but although peat depth is very variable, the vegetation type is not obviously related to peat depth - a few centimetres of peat on Seepage Step Mires can support the same vegetation as peat that is over a metre deep in some Valley Bogs. A few Marl Flushes are on poached calcareous clays with no humus layer.

Hydrology

- 1.10 The New Forest peat bogs are found on permanently saturated soils fed by springs that stay wet over the summer. This is in contrast to the Wet Heath and Wet Lawn found at the edges of the mire where the soils are wet in winter but dry out in summer. The distribution of the bogs depends on the complex hydrology of the underlying Tertiary geology and the overlying plateau gravels. There are numerous small aquifers associated with the bottom of the plateau gravels high on valley sides and the top of bands of clay at varied heights. These can result in more than one spring line on a valley side with separate aquifers producing water with different water chemistry.
- 1.11 Major factors in the water chemistry that influence the characteristics of the bogs are the acidity/alkalinity (pH and cation content), productivity (Carbon/Nitrogen ratio of peat) and aeration (flushed or stagnant).
- 1.12 Within the New Forest, the main Valley Bogs are found within heathland. The ancient, unglaciated and very leached podzols developed in old river gravels under the heaths result in acidic water with an unusually low nutrient status filtering into the aquifers. The bulk of the water feeding into the mires therefore has a similar composition to rainwater (Wheeler & Proctor, 2000). This has major implications for the vegetation formed within the mires, which is not the Poor Fen usually typical of acid groundwater-fed mires, but is very similar to western rain-fed Blanket Bogs (Shaw & Wheeler, 1990). Where the catchment is wooded, with brown earths rather than podzols, (for example, the valley mires within Mark Ash Wood), Poor Fen dominates.
- 1.13 Sources of water from different depths can feed into single mires. Deeper sources of water, especially those rising from contact with the Barton Clay and the Headon Beds are not acidified by filtering through podzols and can have high levels of calcium. In some locations, this is sufficient to result in active tufa deposition. Sources of calcium rich water within the mires

produces localised examples of Marl Flushes on slopes, or Tussock Sedge Fen in valley mires. Dilution of base rich water with the dominant acidic water produces unusual water chemistries (Wheeler & Proctor, 2000) which can result in Transition Mires.

Water Flow and Purple Moor-grass

- 1.14 Faster flowing water is more oxygenated than slow flowing water and the more oxygenated water promotes stronger growth of Purple Moor-grass *Molinia caerulea*, which is fundamental in determining the species diversity of mire vegetation. In the New Forest, however, livestock grazing suppresses Purple Moor-grass growth, allowing other species to flourish. This can be seen in Seepage Step Mires on steep slopes with highly aerated water, which can have Bog-moss dominated surfaces with little Purple Moor-grass, while similar locations with little grazing are likely to form Moor-grass Mires.

Grazing

- 1.15 Grazing is also very important with higher levels of grazing reducing the dominance by a few robust species or tree invasion and maintaining open species rich vegetation. Grazing has the lowest impact in very acid, low productivity poorly aerated peat, which can stay open and species rich with limited grazing pressure. In contrast, in well aerated peat, Moor-grass growth will be strong even with acid water on low productivity peat. Here grazing is essential to maintaining open species rich vegetation.

Valley Bog

- 1.16 Valley Bog vegetation gives the New Forest mires their special character, and represents true bog vegetation growing in groundwater-fed mires, a very unusual situation in European terms (Wheeler & Proctor, 2000). This description includes both valley mires and the seepage step mires found on the valley sides above them.
- 1.17 Valley Bog is characterised by Bog-moss *Sphagnum* lawns dominated by robust, peat forming *Sphagnum* species especially Papillose Bog-moss *Sphagnum papillosum* and *S. medium* (*Sphagnum magellanicum*), together with bog plants such as Bog Asphodel *Narthecium ossifragum* and White Beak-sedge *Rhynchospora alba* (M21a), Heather *Calluna vulgaris* and Cross-leaved Heath *Erica tetralix* are present – both species are absent in Poor Fen. Purple Moor-grass cover is very variable, but it can be high.

- 1.18 Other characteristic species include the bog mosses Cow-horn Bog-moss *Sphagnum auriculatum*, Feathery Bog-moss *Sphagnum cuspidatum*, Flat-topped Bog-moss *Sphagnum fallax*, Red Bogmoss *Sphagnum rubellum* and Soft Bog-moss *Sphagnum tenellum*, with specialist liverworts found as epiphytes on *Sphagnum* hummocks. Frequent vascular plants include Round-leaved and Oblong-leaved Sundew *Drosera rotundifolia* and *Drosera intermedia*, Common Cottongrass *Eriophorum angustifolium*, Many-stalked Spike-rush *Eleocharis multicaulis*, Bog Pondweed *Potamogeton polygonifolius* and Bog Myrtle *Myrica gale*. Rare species include Bog Orchid *Hammarbya paludosa*. Typical Poor Fen herbs (see below) are absent.
- 1.19 As with other types of bog, an important feature of the New Forest Valley Bogs is the hummock structure developed by the differing tolerance of *Sphagnum* species to wetness. The larger robust species, especially Papillose Bog-moss and *S. medium* but also Red Bogmoss, grow above the water table forming mounds, while the lower areas and small pools between support aquatic species Cow-horn Bog-moss, Feathery Bog-moss (larger Bog Pools are an integral part of Valley Bogs but are described separately below). The variable microtopography provides distinct microhabitats for species such as Sundews and Lesser Bladderwort (in the hollows) and Purple Moor-grass, heathers and small bog liverworts (on the hummock tops).
- 1.20 Grazing pressure is a key influence on bog vegetation, particularly away from anoxic stands with less well-developed Purple Moor-grass cover. Well-grazed stands typically support mats of bog-mosses with dense cover of White Beak-sedge. Flushed areas with more Purple Moor-grass provide an important “early bite” for livestock and essential grazing during droughts. Changes in the intensity or pattern of grazing would result in the replacement of Valley Bog with Moor-grass Mire (see below), as would drainage.
- 1.21 This vegetation dominates large areas of both valley and seepage step mires wherever there is acid, nutrient-poor water that is either stagnant enough, and/or grazing is high enough, to restrain the growth of Purple Moor-grass that would otherwise smother the bog-moss communities. Graduation into species-poor Moor-grass Mire is marked by the loss of extensive patches of bog-mosses and the loss of Bog Asphodel and usually occurs in wetter areas that are too swampy for easy access by livestock. At the dry edge of the mires, the more robust *Sphagnum* species (especially Papillose Bog-moss) are lost but Bog Asphodel and White Beak-sedge remain abundant in open Wet Heath (M16c) – a transition that is often gradual and difficult to define.

- 1.22 Where there is a calcareous influence from ground water (but not enough to create Transition Mire, see below) species such as Lustrous Bog-moss *Sphagnum subnitens*, Hooked Scorpion-moss *Scorpidium scorpioides*, Meadow Thistle *Cirsium dissectum*, Pale Butterwort *Pinguicula lusitanica* and Black Bogrush *Schoenus nigricans* are found.
- 1.23 Valley Bog is dependent on extensive impoverished heathland soils within the catchment. Changes from heathland to broadleaved woodland and increased nitrogen deposition from air pollution could lead to the replacement of Valley Bog by poor fen, due to an increase in nutrients. Increased summer drought may cause a change to Wet Heath in marginal areas.

Bog Pools

- 1.24 Bog Pools (M1) are an integral part of wetter Valley Bog. They are characterised by floating bog-mosses, invariably Cow-horn Bog-moss, also often Feathery Bog-moss. Bog Bean *Menyanthes trifoliata* is typical of larger pools. Rare characteristic species include Lesser Bladderwort, Great Sundew, Brown Beak-sedge and Bog Sedge *Carex limosa*.
- 1.25 While smaller pools are probably natural features, at least some larger pools are likely to be the remains of old peat workings. Bog Pools are best developed in the large valley mires of the south of the New Forest, such as Cranes Moor (SU1902), Vales Moor (SU1903), Strogemoor Bottom (SU1803), Holmsley Bog (SU2201) and Hinchleslea Bog (SU2700). Where not threatened by drainage, Bog Pools are a robust habitat and are less dependent on grazing than the surrounding vegetation. However, they can be degraded by disturbance (such as bathing dogs) at crossing points on mires, resulting in turbid water and a loss of aquatic vegetation.

Soakways

- 1.26 Soakways are shallow, well-grazed flow lines at the drier edges of valley mires where they grade into Wet Lawns. Soakway vegetation is often also found in shallow, seasonally-wet seepages within Wet Lawns (see below). It is characterised by the dominance by Bog Pondweed and Bog St John's-wort *Hypericum elodes*, typically with frequent Cow-horn Bog-moss, Lesser Spearwort *Ranunculus flammula* and Bulbous Rush *Juncus bulbosus* (M29). Other typical species include Marsh Pennywort *Hydrocotyle vulgaris*, Bog Pimpernel *Anagallis tenella*, Many-stalked Spike-rush and Round-leaved Sundew.

- 1.27 Soakway stands within mires are swampier than those within Wet Lawns and support species also found in Bog Pools and Transition Mire, two habitats with which it intergrades. These wetter stands include Bog Bean, Bottle Sedge *Carex rostrata*, Water Horsetails *Equisetum fluviatile* and Marsh Lousewort *Pedicularis palustris*. Soakway vegetation also sometimes dominates better defined Bog Streams (see below).
- 1.28 Soakway vegetation is easily eliminated by drainage, but recovery appears to be rapid where natural drainage is restored. The shallow stands are very vulnerable to reduced grazing pressures and water movement favours the growth of Purple Moor-grass, as has happened outside of the New Forest. Degraded examples can sometimes be recognised by relic Bog St John's-wort plants in under-grazed or drained habitats.
- 1.29 Soakways are ubiquitous throughout the New Forest, and examples can be found in almost all mires.

Poached and Disturbed Habitats

- 1.30 Poached peat at traditional crossing points in mires can support significant stands of a characteristic community that includes important populations of the rare Pillwort together with Lesser Marshwort *Helosciadium inundatum* and Floating Club-rush *Eleogiton fluitans*. It is highly dependent on quite intense disturbance by stock crossing mires at habitual locations, producing very localised flooded pools. This community is also typical of ephemeral ponds within Wet Lawns and is also closely related to typical Bog St John's-wort – Bog Pondweed Soakway vegetation. Within mires, most examples are in disturbed areas within flowlines and have a successional relationship with Soakway vegetation, with which it forms gradations.
- 1.31 Another community found in poached and disturbed conditions comprises stands of Many-stalked Spike-rush with Feathery Bog-moss. Also found as permanent vegetation in very acid ephemeral ponds, it has emerged as a pioneer community during large-scale mire restoration and also the restoration of wet heath from conifer plantation. After a few years, it develops into typical Valley Bog or wet heath communities.
- 1.32 The main threat to these communities is that they are not recognised as part of the shifting dynamics of mire but are confused with degraded mire requiring repair work.

- 1.33 These communities are dispersed across the New Forest, but there is particular fine example of the Pillwort community at the head of the valley mire at Magpie Green (SU209000) that feeds into Stoney Moors.

Poor Fen

- 1.34 Like Valley Bog, Poor Fen is dominated by bog-mosses, but these are the more nutrient tolerant species such as Flat-topped Bog-moss and Blunt-leaved Bog-moss *Sphagnum palustre* and the typical Valley Bog species are absent. Common Haircap Moss *Polytrichum commune* is also especially characteristic. Sharp-flowered Rush *Juncus acutiflorus* and grazed Purple Moor-grass are also dominant, while typical Poor Fen herbs include Bog Violet *Viola palustris*, Marsh Willowherb *Epilobium palustre*, Marsh Bedstraw *Galium palustre* and Marsh Pennywort. White sedge *Carex canescens* and Velvet Bent *Agrostis canina* are also characteristic. Other more generalist but typical species include Common Sedge *Carex nigra*, Star Sedge *Carex echinata*, Lesser Spearwort, and Tormential *Potentilla erecta*. Heavily grazed stands are dominated by Bulbous Rush *Juncus bulbosa* (this community is not described in the NVC).
- 1.35 Poor Fen often grades gradually into more heavily grazed Purple Moor-grass Wet Lawn on gley soils, with a reduction in the distinctive Poor Fen species and an increase in the diversity of sedges, with Carnation Sedge *Carex panicea* much more frequent. Poor Fen is also susceptible to invasion by Sallow and Birch, resulting in developing Bog Woodland, but is readily restored from secondary Bog Woodland if trees are removed.
- 1.36 Poor Fen is generally found in mires with acid substrates that are richer in nutrients than those that support Valley Bog (Shaw & Wheeler, 1990). These include mires with catchments dominated by woodland on non-podzolic soils and other situations with naturally less impoverished water sources.
- 1.37 Poor Fen is highly dependent on grazing and is rapidly replaced by the less species-rich Moor-grass Mire on the cessation of grazing. It is rare in lowland England outside of the New Forest. Threats are generally the same as those for Valley Bog, although it is more vulnerable to tree invasion. An expansion of Poor Fen from naturally more productive peats on the peat occupied by Valley Bog (M21a) would be the main indicator of increased nitrogen deposition within the New Forest.
- 1.38 Poor Fen gives a distinct character to the valley mires in the central pasture woodland complex of the New Forest, for example in Mark Ash Wood at

Church Moor (SU247068) and Barrow Moor (SU249073) where it is juxtapositioned with ancient Bog Woodland. It also appears to be long-established on the northern commons, possibly a result of the smaller areas of heath and the presence of more enclosed land within the mire catchments. Good examples include within Cadnam Bog (SU2815) and in the north of Plaitford Common (SU276190 & SU281188).

Moor-grass Mire

- 1.39 Moor-grass Mire is tall and tussocky and dominated by Purple Moor-grass. It is generally species-poor, but there are a few more robust mire species such as Bog Myrtle, Sharp-flowered Rush, and Cross-leaved Heath plus Tormentil and a low cover of the more shade-tolerant bog-mosses. Most stands receive at least some periodic light grazing and are a little more diverse than those characteristic of ungrazed heathlands outside of the New Forest. The boundary between flushed Valley Bog and Moor-grass Mire is indistinct and likely to shift over time with varying grazing pressure.
- 1.40 Moor-grass Mire dominates some of the very wet valley mires in the south of the Forest, especially Denny Bog. Otherwise, it is rather local, other than between Burley and Bolderwood where grazing pressure is generally on the low side and where it dominates seepage step mires.
- 1.41 Where Moor-grass Mire is not dominating the landscape and is present due to natural edaphic factors in locations that are naturally difficult to access by grazing stock, stands add structural diversity and habitat for other wildlife to the mires. Where it is a result of more open mire communities becoming overgrown with Purple Moor-grass and Bog Myrtle, it may be considered a degraded habitat. The presence of Reed *Phragmites australis* in Moor-grass Mire stands is likely to be indicative of lost flushed mires with some base enrichment, including Transition Mires.
- 1.42 Denny Bog (SU3405 to SU3504) appears to naturally have large areas of wet, difficult to access, swampy Moor-grass Mire. The reasons are not clear, although it is thought by archaeologists to be a relatively young late medieval mire, possibly flooded by the creation of Bishops Dyke (Richard Reaves, pers. com.) and may not yet be hydrological stable. However, it has also been disturbed by railway construction and 20th century drainage. Examples of Moor-grass Mire that may have replaced more diverse stands (including Transition Mire) probably due to drainage, can be seen in Holmsley Bog (SU2201) and Wilverley Bog (SZ2499).

Marl Flushes

- 1.43 These support a small-sedge fen community (M10) with characteristic brown mosses and are found in seepage step mires and valley bogs where there is a source of highly calcareous water. The most diagnostic species are Few-flowered Spike-rush *Eleocharis quinquefolia* and the brown mosses Intermediate Hook-moss *Scorpidium cossonia* and Curled Hook-moss *Palustriella commutata*. Associated species include Carnation Sedge, Tawny Sedge *Carex hostiana*, Bog Pimpernel *Lysimachia tenella*, Devil's-bit Scabious *Succisa pratensis*, Marsh Lousewort, Lesser Skullcap *Scutellaria minor* and Quaking Grass *Briza media*. Purple Moor-grass is constant but held in check by tight grazing. Other frequent brown fen mosses include Yellow Starry Feather-moss *Campylium stellatum*, Rusty Hook-moss *Scorpidium revolvens* and Hooked Scorpion-moss.
- 1.44 Marl flushes are heavily grazed and can support a very rich flora including notable species such as Broad-leaved Cottongrass *Eriophorum latifolium*, Common Butterwort *Pinguicula vulgaris* (at one site) and the bryophytes Thick-nerved Apple-moss *Philonotis calcarea* and Narrow Mushroom-headed Liverwort *Preissia quadrata*. Pale Butterwort is more abundant in these flushes than in other mire types in the Forest. The presence of more grazing resistant and tussocky Black Bog-rush gives more structural variation to larger Marl Flushes. Rare swampier stands have more tall sedge cover, including Bottle sedge, and the uncommon Giant Spear-moss *Calliergon giganteum*.
- 1.45 Marl flushes are maintained by grazing and would be rapidly overgrown by Purple Moor-grass and Black Bog-rush then Sallow invasion if grazing declined or drainage carried out.
- 1.46 Most Marl Flushes are small valley side seepages scattered across the south of the Forest but there is an exceptionally large marl mire at Stony Moors that merges into Valley Bog. Examples of smaller high-quality mires include Acres Down (SU270 085), a seepage step mire, with the only New Forest population of Common Butterwort and a good population of Thick-nerved Apple-moss. At Elkhams Grave (SZ261 988), a spring with a very wet swampy variant and Widden Bottom (SZ288 992), there are series of springs on the slopes, which merge into the head of a valley mire. The base rich water from these springs feeds into the adjacent main valley mire and feeds a fine example of Transition Mire.

Transition Mire

- 1.47 Transition Mire is a rare and unusual vegetation type that is transitional between Valley Bog and Marl Flush in terms of floristic composition and general ecological characteristics. In the New Forest, it occurs where there is mixing of acid and alkaline water producing unusual and unstable chemical conditions with water pH ranging from 5.0 to 6.0 (Wheeler & Proctor, 2000). The vegetation is very variable and poorly characterised by the NVC. Most stands support the moderately base demanding brown moss Yellow Starry Feather-moss with Purple Moor-grass, Many-stalked Spike-rush, Bog Myrtle, Bog Pimpernel and Carnation Sedge. Two types have been described by Sanderson.
- 1.48 Swampy stands include Bottle Sedge, Bog Bean, and the moderately base demanding brown moss, Yellow-Starry Feather-moss. Distinctive associated species include Slender Cottongrass, Great Sundew, Bog Sedge, Slender Sedge *Carex lasiocarpa* and the moderately base demanding bryophytes Rusty Hook-moss, Hooked Scorpion-moss, Ringless Hook-moss *Warnstorfia exannulata*, Rigid Bog-moss *Sphagnum teres* and the regionally rare Twisted Bog-moss *Sphagnum contortum* and Slender Cow-horn Bog-moss *Sphagnum subsecundum*. Species of highly base rich or acid conditions also occur occasionally. Swampy stands are vulnerable to invasion by Sallow *Salix* and Alder *Alnus* (Chatters & Sanderson, 1994) while flushed stands are more robust provided grazing levels are adequate.
- 1.49 Flushed stands lack the tall sedges and typically have Cross-leaved Heath, Sharp-flowered Rush, Bog Pondweed, Bog Pimpernel, Bog Asphodel, Carnation Sedge, Round-leaved Sundew and Meadow Thistle. A characteristic moss is Rusty Hook-moss. Acid demanding species are more frequent than in the swampy stands due to the formation of hummocks with the base tolerant Lustrous Bog-moss low down and the base intolerant Papillose Bog-moss and other acid-loving species higher up. Occasionally the base tolerant Twisted Bog-moss and Slender Cow-horn Bog-moss occur within the runnels. The flushed Transition mires locally support the Endangered Southern Damselfly.
- 1.50 Swampy stands occur where base-rich ground water enters acid Valley Bog, either from Marl Flushes rising on the slopes above or as artesian water sources within the mire. Flushed stands occur on slopes where base-rich (but not tufa depositing) water rises from clays, usually the Headon Beds and Barton Beds, or where tufa depositing water is diluted by flowing into more acidic water.

- 1.51 Flushed Transition Mire is widespread on the Headon and Barton Clays, often as small runnels in other mire and wet heath vegetation. Good examples within more acidic mires can be seen at Foulford Bottom (SU1805), and Burley Common Moor (SU2004). The community also occurs associated with Marl Flushes where the water from these is being diluted by more acidic water, as at Stony Moors (SZ2199) and Acres Down (SU270 085).
- 1.52 Swampy Transition Mire within valley mires can be more substantial. The most impressive of these includes the recently restored stand flanking the Alder Moor in Fort Bog (SU3308) on Matley Heath that supports a huge population of the English Vulnerable Red List species Slender Cottongrass, following the removal of post-Second World War Sallow scrub from the base enriched flow line. Other significant stands are found at Widden Bottom (SZ2899) and Holmsley Bog (SU2201), both also with Slender Cottongrass, and Wilverley Bog (SZ2499).

Tussock Sedge Fen

- 1.53 Tussock Sedge Fen (M25b) is rare in the New Forest, being largely restricted to the Holmsley Mire system. The few relics were in poor condition until conservation management of Sallow and Alder (aimed at creating habitat for Slender Cottongrass) resulted in the re-emergence of this vegetation type. It is characterised by large bulky sedges (especially Tussock sedge *Carex paniculata*), Reed and Bottle Sedge are interspersed with open pools and brown moss mats. The mosses are often dominated by the rare fen specialist moss Giant Spear-moss *Calliergon giganteum* while the rare base-demanding Rigid Bog-moss occurs in patches. The regionally rare Felted Thyme-moss *Rhizomnium pseudopunctatum* has been found in the restored fen.
- 1.54 Fen herbs include Wild Angelica *Angelica sylvestris*, Kingcup *Caltha palustris*, Marsh Willowherb, Marsh Horsetail *Equisetum palustre*, Fen Bedstraw *Galium uliginosum*, Ragged-Robin *Lychnis flos-cuculi*, Yellow Loosestrife *Lysimachia vulgaris*, Bog Bean and Marsh Cinquefoil *Comarum palustre* (Sanderson, 2006). Most of the diversity occurs in the pools and runnels between the Tussock sedge tussocks.
- 1.55 Tussock Fen Sedge is mainly found where calcareous water from the Headon Beds rises within a mire system. It is very vulnerable to tree invasion, and prior to restoration, much of the potential habitat was occupied by Alder Moor (itself a habitat of interest). These areas are shown as open mire or open with scattered trees on 19th century maps, when the fen was probably

kept open by Alder coppicing combined with grazing. The fen is dependent on winter pony grazing of the Tussock Sedge to prevent the dominance of the sedge and maintain species- richness.

- 1.56 Tussock Sedge Fen is currently found in Holmsley Bog, north of the old railway (SU225011 – SU225011). Extensive areas of restored fen south of the railway have been largely recolonised by Tussock Sedge. A small area of open over-grown Tussock Sedge Fen at Fort Bog, Matley Heath (SU334 083) has been restored and extended by felling Sallow and Alder that has developed since the mid-20th Century. Some very overgrown and rather species poor open Tussock Sedge Fen survives in the west of Wilverley Bog (SU24001).

Bog Woodland

- 1.57 This habitat includes long-established woodland growing in a stable relationship with bog vegetation (W4b,c). Birch is often dominant, with Sallow and sometimes Oak *Quercus* and rarely Yew *Taxus baccata*, with Holly *Ilex aquifolium* on the drier root plates of the canopy trees. Some have a rich epiphytic flora. Bog-mosses can be a prominent feature of the ground flora, with Purple Moor-grass, Sharp-flowered Rush and Poor Fen species such as Greater Bird's-foot-trefoil *Lotus pedunculatus*, Marsh Violet and White Sedge in more flushed stands.
- 1.58 On very wet peats, extremely swampy stands are dominated by Sallow with a very limited ground flora of Purple Moor-grass tussocks. Stands along the Avon Water have slightly raised mounds of peat within the mire with mixtures of Birch, Oak, Holly and Yew including some taller trees and occasionally large ancient Oak and Yews. The less flushed peat lacks the Sharp-flowered Rush and the frequency of poor herb of the more flushed peats (W4c).
- 1.59 Bog Woodland is found in flow lines in valley mires and along the edges of Riverine Woodlands where the mire merges with floodplains. Stands often grade into less acid Alder Moor (W7b & W5b) at the downstream end of the mire. New woodland on bog develops through the invasion of open mire, especially Poor Fen stands, but in conservation terms, old long established stands are more important.

Alder Moors

- 1.60 Alder Moors are swampy stands of Alder dominated by Tussock Sedge and Reed (W5b). Sallow infills canopy gaps and sometimes Holly grows on Alder

stools. There is a rich associated flora including many fen herbs, including Yellow Loosestrife, Water Mint *Mentha aquatica*, Kingcup *Caltha vulgaris* and Meadowsweet *Filipendula ulmaria*. Specialist species of the habitat include Royal Fern *Osmunda regalis* and the rare Marsh Fern *Thelypteris palustris*.

- 1.61 In addition to ancient stands there are areas that have expanding since the 1870s, most likely at the expanse of open Tussock Sedge (see above). Most stands were coppiced for charcoal in the past and this would have produced open fen alternating with closed woodland.
- 1.62 Alder Moors are generally found on soft wet peat with base-rich water sources arising in larger valley mires in the south of the Forest. Flushed stands with small sedges, especially Remote Sedge *Carex remota* (W7), are mainly found in floodplain habitats and small flushes with woods.

Rivers and streams

Introduction

- 1.63 The streams and rivers of the New Forest are relatively short and arise within the Forest. Their catchments are therefore largely uncultivated and so the water quality is generally excellent, protected from the artificial nutrient-enrichment caused by run-off from adjacent agricultural land that affects so many lowland waterways. However, the low reaches are more vulnerable to pollution incidents. The detrimental effects of drainage, canalisation and tree planting have been significant, but restoration has proved effective. For comprehensive summaries of the ecology and diversity interest of the New Forest streams in general see Langford (1996) and Langford *et al.* (2010).



Ephemeral Headwater Streams are mainly found on Wet Lawns that are not fed by large mires, so water flow is low in summer and the streams sink into the underlying alluvium. The streams are characterised by vegetated beds containing Soakway vegetation, interspersed with gravel-based pools.



Bog Streams & Slow-flowing Oligotrophic Streams are both characterised by acidic nutrient-poor water, fed from large valley mires. Bog streams are peaty on the bottom and along the edges of the stream and are edged with Marsh St John-wort, Bulbous Rush, Bog-mosses and Bladderwort in the channel. Slow-flowing Oligotrophic Streams have gravel beds.



Faster-flowing Oligotrophic Streams are shallow, acidic headwater streams with gravel beds, that flow through wet heath or *Molinia* Wet Lawns. Marginal vegetation very similar to Soakway tends to dominate pools.



Mesotrophic (neutral) Streams are meandering streams with a reasonable gradient found flowing through deep alluvium deposits. At higher gradients, riffles in the stream support Crowfoot and Water Starworts, whilst in streams with very low gradients there are extensive pools with Yellow Water-lily.



Incised Woodland Streams are meandering streams that are deeply incised. These larger streams cut into old terraces and can create new floodplains or extend existing downstream floodplains. Shading means there is little aquatic or marginal vegetation.



Woodland Floodplain Streams are more dynamic than the open streams, with a greater complexity of flood channels, encouraged by debris dams and the resistance of tree roots and trunks to erosion. Shading means that aquatic vegetation is limited, but in glades there is similar aquatic vegetation to that found in open streams.

Ephemeral Headwater Streams

- 1.64 Summer-dry headwater streams are found where there are no large mires to feed the stream year-round. Instead, the stream dries out in the summer. Where the water flow is slow, the streams consist of vegetated beds interspersed with deeper gravel-based pools. Such streams are generally found on shallow alluvium overlying head deposits in Wet Lawns in heads of valleys, either in heathland or woodland glades. Where the volume and velocity of the water flow is higher, the streams have coarse gravel beds within more incised channels and pools that last longer into the summer, but

with limited vegetated. They are, however, known to harbour some specialised rare invertebrates. These faster-flowing streams are found in heathland valleys in the north-west of the Forest.

- 1.65 In slow-flowing ephemeral streams, the stream bed between the gravel pools supports vegetation similar to the Soakways found in the drier parts of the mires. It is characterised by Marsh St John's-wort but with less Bog Pondweed than in mires and a high cover of Bulbous Rush, Velvet Bent and Floating Club-rush, together with Lesser Spearwort, Bog Pimpernel, Marsh Pennywort and Common and Many-stemmed Spike rushes Common Spike-rush *Eleocharis palustris* and Many-stalked Spike-rush. The nationally Near Threatened and England Vulnerable Lesser Water-plantain *Baldellia ranunculoides* occurs occasionally.
- 1.66 Ephemeral headwater streams have been badly damaged by past drainage as they tend to be located with Purple Moor-grass Wet Lawns that were particularly targeted for drainage. Even quite shallow drainage ditches proved to be damaging, and very few Ephemeral Headwaters Streams have survived intact. This habitat, however, readily recovers if the ditches are infilled and recent restoration has recreated some fine examples. Howen Bottom (SU2315) has a well-developed example of a relatively recently restored slow flowing Ephemeral Stream while a good example of a faster flowing Ephemeral Stream is the Ditchend Brook (SU1814 – SU2116) although Black Gutter has been heavily drained.

Bog Streams and Slow-flowing Oligotrophic Streams

- 1.67 Streams fed by the larger valley mires are very acidic and nutrient-poor (oligotrophic). True Bog Streams flow through peat, while slower moving streams just downstream of the bogs have similarly acidic, nutrient-poor water, but with gravel beds. Bog Streams are very rare nationally.
- 1.68 Bog Streams are often edged with Marsh St John's-wort Soakway vegetation (see above), with Bulbous Rush and Cow-horn Bog-moss or Feathery Bog-moss still water in the channel. Lesser Bladderwort is a typical associate and the very rare Intermediate Bladderwort *Utricularia intermedia* (*sensu stricta*) occurs in the Denny Bog complex in one of its few confirmed British locations. Bottle Sedge also forms open stands. As the Bog Streams develop into streams with gravelly bottoms, Alternate Water-milfoil *Myriophyllum alterniflorum* beds appear.

- 1.69 Drainage ditches dug within bogs have damaged many Bog Streams, but there is a good undamaged example draining Cranes Moor (SU1802). The Bog Stream in the lower section of Denny Bog (SU3504) is impressive where restored and can still be traced where partly drained. The natural section of stream within the bog below Holmsley passage is extant but rather damaged by Sallow invasion (SU2201).

Faster-flowing Oligotrophic Streams

- 1.70 Headwaters streams running through Wet Heath or Purple Moor-grass Wet Lawns that are mainly fed by large valley mires are less prone to drying out than Ephemeral Streams but are also acidic and nutrient-poor, with low silt loads. These shallow, short tributary streams are characterised by extensive riffles, interspersed with shallow pools and the mobile gravel of the streambed supports few aquatic plants. Marginal vegetation is patchy and generally comprises the Marsh St John's-wort Soakway community or sometimes Poached and Disturbed Habitat with Pillwort where the banks are poached. Soakway vegetation can also dominate some pools. The channel is often lined with Bog Myrtle bushes.
- 1.71 Again, many of these streams were damaged by drainage in the past but are widespread throughout the New Forest. The Crockford Stream (SZ3499 to SZ3598) is a particularly special example with more Pillwort than usual and strong populations of the Endangered Southern Damselfly.

Mesotrophic (Neutral) Streams

- 1.72 Mesotrophic (neutral) Streams are meandering streams with a reasonable gradient found flowing through deep alluvium deposits. The more nutrient-rich water means that the surrounding floodplain usually supports the more productive Sharp-flowered Rush Wet Lawn, sometimes with patches of Riverine Woodland or riverside Alders. The streams have clear water during low flows but carry significant silt loads when in flood. These streams become slower-flowing lower down the catchments.
- 1.73 Where the streams are faster-flowing, due to the gradient, the high flow rate results in widespread riffles but with frequent pools (although not usually the large, deep pools characterised by Yellow Water-lily *Nuphar lutea*). The streams are well-vegetated where unshaded, although open gravel beds are also frequent. Riffles support an abundance of Pond Water-crowfoot *Ranunculus peltatus* and Water Starworts, especially the river specialist Blunt-fruited Water-starwort *Callitriche obtusangula*. Associated species include

Alternate Water-milfoil, Canadian Pondweed *Elodea canadensis*, Bog Pondweed, Broadleaved Pondweed *Potamogeton natans*, and Unbranched Bur-reed *Sparganium emersum*. Pools have higher covers of Alternate Water-milfoil and Canadian Pondweed, the latter more frequent where more silt is deposited.

- 1.74 The grazed margins have short, open vegetation consisting of mixtures of species such as Fool's Watercress *Helosciadium nodiflorum*, Blinks *Montia fontana* ssp *amporitana*, Water Forget-me-not *Myosotis scorpioides* and Watercress *Rorippa nasturtium-aquaticum* agg, Floatgrass *Glyceria declinata* and Water-pepper *Persicaria hydropiper*. In contrast, where scrub prevents livestock from accessing the streams there are stands of Bur-reed *Sparganium erectum*. Poaching by livestock adds species such as Creeping Bent *Agrostis stolonifera*, Nodding Bur-marigold *Bidens cernua*, Water-purslane *Lythrum portula*, Water-pepper and Lesser Spearwort.
- 1.75 Slow-flowing Mesotrophic Streams are generally found lower down catchments and differ from faster-flowing Mesotrophic Streams only in the stream gradient, which is shallower, leading to more extensive pools. The communities are the same, but the pools also support Yellow Water Lily and the ungrazed swamp vegetation is more widespread.
- 1.76 In slow-flowing Mesotrophic Streams, the faunal assemblages are closer to typical lowland rivers than the other New Forest streams, exemplified by the presence of White-legged Damselfly *Platycnemis pennipes* (once confined to a very slow moving section of the Ober Water, but recently found in similar habitat in the restored Black Water in Dames Slough Inclosure (R. Reaves, pers.com.)). There were significant losses of open Slow-flowing Mesotrophic Streams due to the natural spread of Riverine Woodland in the 19th century.
- 1.77 Longwater Lawn (SU3208) is one of the best examples of a fast-flowing Mesotrophic Stream. Here, cut off meanders were recently re-joined to the main channel. The Ober Water between Markway Bridge and Puttles Bridge (SU2503 to SU2603) is the best example of slow-flowing Mesotrophic Stream in the New Forest, while the recently-restored Black Water in Dames Slough Inclosure (SU2404 & SU2504) is also developing into a good example.

Incised Woodland Streams

- 1.78 Where larger streams or rivers cut into old river terraces, the meandering channels can be incised. These streams are, in effect, creating new floodplains or extending existing downstream floodplains and some already

have the beginnings of a new floodplain developing inside the meanders. These channels are invariably within pasture woodlands, possible because the banks are difficult for livestock to graze, allowing tree regeneration.

- 1.79 Naturally incised streams should be differentiated from the deeply entrenched streams formed by the canalisation of shallower streams and creation of side drains within the Inclosures in the 19th and 20th Centuries. This allowed the water to flow faster, eroding the stream bed. Such streams can be distinguished by the straightness of the channel and the lack of meanders meaning they are less structurally diverse and therefore less biodiverse.
- 1.80 Incised Woodland Streams are comparable to faster-flowing Mesotrophic Streams but because of their woodland context, they have little aquatic or marginal vegetation. Debris dams are frequent and the meandering channel leads to patterns of deep pools where the river is under cutting the banks and riffles where it is depositing. The banks support rich woodland floras, including species sensitive to grazing.
- 1.81 Natural examples of this type of stream are robust and have survived well. The best example is Bartley Water in the open Forest pasture woodlands in the Busketts Wood area (SU3010). Also of interest is the Highland Water at Great Huntly Bank (SU2705 & SU2706) where the channel is at a more advance stage of erosion, with the beginnings of a new floodplain developing and upstream and downstream of Millyford Bridge (SU2707 – SU2608).

Woodland Floodplain Streams

- 1.82 In their lowest reaches, the rivers flow slowly through Riverine Woodlands and would be considered as slow-flowing Mesotrophic Streams if in the open. The wooded floodplains are more dynamic than the open ones, with a greater complexity of flood channels, encouraged by debris dams and the resistance of tree roots and trunks to erosion.
- 1.83 The aquatic vegetation is limited in extent, due to shading. Where the river flows through open glades, similar aquatic communities to that found on the Mesotrophic Streams occurs, including Pond Water-crowfoot in the riffles and Yellow Water-lily in pools. In wooded streams with frequent debris dams, the flow is slowed further and the extent of riffle habitats reduced while the number of pools increases.
- 1.84 The best example of a slow-moving wooded river is the lower Beaulieu River from North Gate to Ipley (SU3804 – SU3806). Here, a regionally rare specialist

aquatic species Red Pondweed *Potamogeton alpinus* is confined to the wooded section of the river.

Floodplains



Wet Lawns found within floodplains are generally close-grazed and characterised by abundant Velvet Bent, Carnation Sedge and Common Sedge with variable amounts of grazed Purple Moor-grass and Sharp-flowered Rush.



Ephemeral Communities are a number of disparate amphibious communities that occur in grazed and poached water margins, which flood in winter but dry out in summer. Communities include the vulnerable Pillwort and Small Water-pepper.



Scrub can establish on the floodplains, despite high levels of grazing. Floodplain scrub is usually dominated by thorn shrubs, mainly Hawthorn and Blackthorn, but can also have emergent young trees.



Riverine Woodland describes mixed woodlands that dominate dry mineral soils on the levees of ancient woodland. Old-growth stands are dominated by Oak and Ash, with Alder scattered along channel-edges and a varied shrub layer.

Introduction

- 1.85 Within lowland England, the unenclosed floodplains of the New Forest streams and rivers are very unusual. By the medieval period, most lowland floodplains had been enclosed for the production of hay to sustain livestock over the winter period or had been drained and cultivated. In contrast the New Forest floodplains largely remained open and uncultivated.
- 1.86 Floodplains are defined here as areas adjacent to watercourses which become flooded in the winter periods when the volume of water becomes too great to be contained within the channel (although in many cases the hydrology has been altered and the natural flooding is greatly reduced). Floodplains develop on the middle to lower reaches of the New Forest streams and rivers where the velocity of the water slows down and sediment deposition dominates, rather than erosion. Seasonal flooding can be of quite

short duration, and in the summer the floodplain habitats can dry out significantly.

- 1.87 Within the New Forest, the typical floodplain habitats include alluvial grasslands³, known locally as Wet Lawns, and Riverine Woodland. The Wet Lawns can include ephemeral pools and channels. These features are not unique to the floodplains and can also be found in seasonally wet soils⁴ away from the floodplains. Wet heath is also a component of floodplain habitat as it is found at the peripheries of Wet Lawns. Not technically wet wetland habitat, it is described separately below.
- 1.88 The floodplains provide the most fertile grazing within the New Forest and so are more heavily grazed than the surrounding heathlands and woodlands. The grasslands are also typically more heavily grazed than examples of the same unimproved grasslands outside of the open Forest. The swards tend to be grazed short and are species-rich, intimate mixtures of grasses, sedges, rushes and herbs, but with limited structural diversity. As a result, grassland types that are quite structurally distinct elsewhere, such as Purple Moor-grass *Molinia* and Rush *Juncus* dominated wet grasslands, require you to crawl on hands and knees to see the quite clear-cut floristic differences.

Geology and topography

- 1.89 The streams of the New Forest flow within a series of eroded ancient river terraces, which are heavily dissected by the stream valleys. The stream profile is often step-like, with a corresponding series of floodplains. The stream cuts a narrow channel into a river terrace. These narrow channels are the beginnings of new floodplains and effectively cut back into the upstream floodplain through a natural nick point. While artificial drainage can accelerate these natural nick points, to the point where they become highly damaging, nick points are a natural feature of the New Forest.
- 1.90 A number of separate floodplains may be associated with a given watercourse, depending on its length and gradient. For example, the Highland Water (which changes from 95m to 10m in altitude) has three large obvious floodplains lower down and several smaller ones towards the headwaters. In contrast, the Beaulieu River (with altitudinal change from just 20m to 5m) has a single uninterrupted floodplain.

³ i.e. grasslands developed on loose clay, silt, sand, or gravel that has been deposited by running water on its floodplain.

- 1.91 The floodplains of the lowest sections of the larger rivers develop in deep alluvium through which the rivers meander. Further upstream nearer the headwaters, the streams are weaker and less dynamic and develop smaller floodplains.

Soils

- 1.92 The soils of the New Forest floodplains are predominantly seasonally waterlogged alluvial gley soils⁵, often with better drained topsoils (especially near the river). Further from the river, wetter soils dominant with shallow peaty topsoils. Drier gleyic brown alluvial soils can occur with the gleying more than 40cm below the surface, on raised areas, including on mounds of dredged sediments but also on naturally raised areas. Peat soils occurring on floodplains are determined by the presence of ground water springs or inflowing water from adjacent mires, not flooding.

Hydrology

- 1.93 The hydrology and physical morphology of the larger floodplains is complex, with flooding river water, inflow of surface water, springs, sediment deposition and disruption by past drainage works. Along the watercourse, silt deposition creates slightly raised, drier areas ("levees"). This natural feature is usually fairly slight within the New Forest but has often been exaggerated by past dumping of dredged sediment. It results in slightly better drained and more fertile habitat along the stream. Lower-lying depressions ("backswamps") further from the watercourse hold water that cannot readily drain into the stream due to the levees and so tend to be wetter. Backswamps furthest from the watercourse tend to be fed by acidic surface water (sometimes augmented by ground water) from the adjacent heathland. This can lead to saturated conditions being longer-lasting or permanent, in contrast to areas nearer the watercourse, where floodwater, which drains away more quickly, is more important.
- 1.94 The morphology of headwater floodplains is usually much simpler and the vegetation they support often resembles the backswamp sections of the larger floodplains.

Land use

⁵Waterlogged soils in which a lack of oxygen has causes iron and manganese to reduce, resulting in a greyish-blue colour

- 1.95 Wet Lawns are maintained by the New Forest commoners' livestock that roam freely in the open forest. Without grazing, they would gradually revert to woodland. A focus for grazing, these areas are much valued by the commoners and there has been pressure to reduce or prevent the spread of scrub and to reduce flooding to ensure that lying floodwater does not create swampy areas. As a result, there have been various drainage schemes since the 19th century (Passmore, 1977 & Tubbs, 2001) and invasive scrub has been cut back.
- 1.96 However, drainage, which interferes with the natural function and dynamics of the floodplain, reduces the wetland habitats that add greatly to the habitat diversity of the floodplains. It can also result in scrub and trees invading former wet habitats. The negative impacts of drainage are widely recognised and river restoration programmes have been reversing these.
- 1.97 Drainage was also carried out carried out in the 19th- mid-20th Centuries within Riverine Woodlands. Canalization in and near Inclosures has been particularly damaging, reducing flooding and simplifying the structure of the wet woodland.
- 1.98 Past scrub management focussed on young, low, dense scrub, leaving taller stands of Sallow and Oak to develop and creating sharply demarcated stands of woodland and grassland without a transitional scrub margin. However, where old scrub stands and developing secondary woodland have been managed, rather than exclusively younger scrub stands, both high quality scrub and species-rich grassland can be maintained together, such as at Linford Bottom

Wet Lawns

- 1.99 The dominant communities of unwooded floodplains are wet grasslands with Velvet Bent, Carnation Sedge and Common Sedge and variable amounts of closely grazed Purple Moor-grass and Sharp-flowered Rush. Known as wet lawns, these are generally closely grazed and have a similar overall character, although they diverge when looked at in more detailed and different types occupy different locations on the floodplain (Sanderson, 2002). Wet Lawns support many wetland plants that are declining in lowland England, but few Threatened species, the latter being mainly found in associated amphibious communities in the ephemeral ponds and channels. This habitat is also used by the important wader populations on the Forest, with Lapwing *Vanellus vanellus* breeding on the less disturbed lawns.

- 1.100 The more fertile stands in the large floodplains lower down the river systems have a greater prominence of Sharp- Flowered Rush with less Purple Moor-grass (M23a). These stands are generally near the watercourse where the soils are enriched by silt-laden floodwaters. Along with the Sharp-flowered Rush, frequent to abundant species include Velvet Bent, Yorkshire Fog, *Holcus lanatus*, Common Sedge, Marsh Pennywort, Carnation Sedge, Oval sedge *Carex leporina* (*Carex ovalis*), Marsh Bedstraw, Greater Bird's-foot-trefoil and Water Mint. Sometimes rushes are absent, but these swards are otherwise very similar to those with rushes. The increased fertility of this grassland type compared to the *Molinia* grasslands of the fringing wetlands is illustrated by the greater abundance of species such as Crested Dogstail *Cynosurus cristatus*, Tufted Hairgrass *Deschampsia cespitosa*, Lady's Smock *Cardamine pratensis*, Common Sedge, Oval Sedge, Marsh Thistle *Cirsium palustre*, Meadowsweet, Marsh Bedstraw, Soft Rush *Juncus effusus*, Water Mint, Tufted Forget-me-no *Myosotis laxa*, Tubular Water Dropwort *Oenanthe fistulosa*, Silverweed *Potentilla anserina*, Selfheal *Prunella vulgaris*, Creeping Buttercup *Ranunculus repens*, Marsh Ragwort *Senecio aquaticus* and White Clover *Trifolium repens*. The sward surface is usually smooth with few hummocks. This vegetation grades into the Neutral Greens (referable to MG6 Ryegrass pasture *Lolium perenne*-*Cynosurus cristatus*) in drier sections of the lower floodplains, including naturally drier levees, ditch mounds and drained floodplains.
- 1.101 In backswamps and headwater floodplains, inflowing acidic surface water from the surrounding heathland has more of an influence. Here, less fertile and often hummocky stands are characterized by more abundant Purple Moor-grass (although typically with leaves only to 4cm in height) and reduced amounts of Sharp-flowered Rush (M24c & M25b). The change to this grassland type can be quite sharp. Other frequent to abundant species include Velvet Bent, Sweet Vernal Grass *Anthoxanthum odoratum*, Heath Grass *Danthonia decumbens*, Bog Pimpernell, Star Sedge, Carnation Sedge, Yellow Sedge *Carex demissa*, Meadow Thistle, Greater Bird's foot-trefoils, Tormantil, Lesser Skullcap, Devil's-bit Scabious and Cow-horn Bog-moss. This vegetation type also dominates floodplains higher up the streams and in headwaters, where the floodwater is less silty.
- 1.102 The presence of low hummocks is a very characteristic feature as opposed to the mainly smooth surfaces of the Sharp-flowered Rush Wet Lawn swards. The presence of Heather and Cross-leaved Heath on mounds towards the

edges of floodplains mark a transition into species-rich wet Tussock Heath (M16b, Tussock Heath) off the floodplain – there is a transitional, grassy variant.

- 1.103 Unlike the Sharp-flowered Rush Wet Lawns, the Purple Moor-grass Wet Lawns are widespread off the floodplains, on clay slopes and flushed glades in pasture woodlands.

Ephemeral hollows and pools

- 1.104 Within in the lawns, old channels and other hollows support various ephemeral pond communities of amphibious plants. These grade into Soakway communities (see Peat Bogs) in seasonally dry channels with some water flow. In headwater floodplains, the streams themselves seasonally dry out and also support this type of vegetation (see Streams and Rivers). These ephemeral pools, pans and channels change greatly through the year, varying from flooded to muddy with amphibious vegetation to dry and trampled. They also vary according to their acidity and nutrient status. They can support rare and declining species, such as the Vulnerable Pillwort and Small Water-pepper *Persicaria minor*. There are also many commoner wetland and ruderal species. Some change over time is also apparent, for example, the rare Hampshire-purslane *Ludwigia palustris* has become more widespread in recent years.
- 1.105 Ephemeral vegetation in the New Forest is quite varied and includes assemblages that are rare or absent on less closely-grazed wet grasslands outside of the New Forest. Some are not described within the National Vegetation Classification (Rodwell, 1991).
- 1.106 In lower nutrient conditions, in headwaters floodplains and within the Purple Moor-grass Wet Lawn, both flood channels and summer dry streams where there is a good flow of water when wet support Soakway Vegetation characterised by Marsh St. John's-wort such as that found in the drier parts of the mires. Within the wet grasslands, these stands tend to have less Bog Pondweed, but high covers of Bulbous Rush, Velvet Bent and Floating Club-rush along with Lesser Spearwort, Bog Pimpernel, Marsh Pennywort and the Spikerushes Common Spike-rush and Many-stalked Spike-rush. The England Vulnerable Lesser Water Plantain occurs occasionally.
- 1.107 Hollows and channels with slower flowing water (when wet) support similar vegetation, but Marsh St. John's-wort is rare and species such as Pillwort, Lesser Marshwort and the nationally rare Hampshire-purslane are

prominent and Lesser Water Plantain more frequent. Velvet Bent is absent and additional species include Floatgrass, Water Purslane, the nationally rare Water Crowfoot *Ranunculus x novae-forestae*, Tubular Water Dropwort and Marsh Speedwell *Veronica scutellata*.

- 1.108 In shallow pans with some poaching within Purple Moor-grass Wet Lawn, a pan community with Silverweed and Creeping Bent plus Jointed Rush *Juncus articulatus*, Bulbous Rush and the nationally rare Slender Marsh-bedstraw *Galium constrictum* is found, together with species typical of the Purple Moor-grass Wet Lawn sward.
- 1.109 In the more heathy areas at the edge of floodplains, summer-dry pans and hollows support a transition to a more acidic Many-stalked Spike-rush – Feathery Bog-moss assemblage.
- 1.110 Some headwater floodplains contain hollows dominated by Shoreweed *Littorella uniflora*, which are more typically found off the floodplains.
- 1.111 More nutrient-enriched, open assemblages of amphibious vegetation are found in similar ephemerally flooded habitats nearer to rivers or in areas regularly flooded by river water in the lower reaches. These lack the distinctive species such as Pillwort, Lesser Marshwort, Lesser Water-plantain and Marsh St. John's-wort but include Water-pepper (which is often prominent) and Creeping Bent, Floatgrass, Fool's Watercress, Nodding Bur-marigold, Water-purslane. The Vulnerable Small Water-pepper also occurs in this vegetation, which can be found off the floodplains in track ruts but is more varied and extensive on the floodplains.
- 1.112 Other associated communities are found in the areas flooded by more nutrient-rich river water. In very trampled areas, such as at crossings and watering points, small patches of species-poor communities with Creeping Bent, Marsh Foxtail *Alopecurus geniculatus*, Water-pepper and Marsh Cudweed *Gnaphalium uliginosum* can be found (MG13). The more stable margins of the streams are mostly grazed, with open communities of species such as Fool's Watercress, Blinks, Water Forget-me-not and Watercress, with Floatgrass and Water-pepper (S23).

Scrub

- 1.113 Despite being close-grazed, Wet Lawns can still be invaded by patches of scrub, mainly Hawthorn *Crataegus mongyna* and Blackthorn *Prunus spinosa* (W21 & W23). Alder can also colonise the riverbanks and on the less productive Purple Moor-grass lawns, Bog Myrtle, which is little grazed, can

act as a locus for shrub and tree colonisation. Where thorn scrub is not managed, it has the potential to be invaded by tree species and develop towards Riverine Woodland.

Riverine Woodland

- 1.114 In addition to sizable areas of recent developing Riverine Woodland (see above), the New Forest includes some remarkable and internationally rare old-growth floodplain woodlands on the lower parts of the rivers. These are species-rich, structurally complex and dynamic, with the presence of veteran trees leading to large volumes of fallen dead wood and the generation of debris dams. Within the woods the drier levees support Oak – Ash dominated stands of hardwood riparian woodland (W8b & W8f), i.e. with tall canopy trees dominant rather than Alder or Willow dominant (that is softwood riparian woodland). These have damp woodland ground floras rich in spring ephemerals. This is a very rare habitat in a European context.
- 1.115 In the wetter spring fed back swamps, old channels and headwater wetlands transitioning from valley mires, Flushed Aldermoor communities dominate (W7b & W7b). These have Alder and Sallow dominant over ground floras with mixtures of small sedges and wetland herbs.

Wet heath

Introduction

- 1.116 Wet Heath is found where drainage is impeded on heathland, particularly on the edge of peatbogs but also in depressions or around pools and on the peripheries of floodplains and, in the northern New Forest terraces, clothing the bottom of shallow valleys (Rodwell, 1991). In the New Forest, the transitions to dryer and wetter habitats are particularly well developed. Four main types of Wet Heath are found, depending on soil characteristics and hydrology.

Soils and hydrology

- 1.117 Wet Heath is found on seasonally waterlogged shallow peat and nutrient-poor mineral soils. Essentially, it is found where soils are too dry to sustain large, peat-building bog-mosses (such as *Sphagnum papillosum* and *S. magellanicum*) but are too wet to support Bell Heather, favouring Cross-leaved Heath which can tolerate waterlogging.

- 1.118 Wet Heath communities vary according to soil moisture, nutrient and base status (Wright and Westerhoff, 2001). Tussock Heath is found on more base-rich soils (sometimes exceeding pH 5) where the steady flow of surface water encourage the growth of Purple Moor-grass tussocks, while an acid sward more closely related to peatbog vegetation is found in hollows and in transitions with Valley Mire. In the New Forest, an additional type is recognised and referred to as Humid Heath. This is found in a wide band between Wet Heath and drier heathland habitats and is intermediate in character. It is particularly characteristic of the New Forest, where the relatively high clay content of the soil allows a transitional zone rarely seen elsewhere.

Burning, grazing and drainage

- 1.119 Wet heath in the New Forest is profoundly influenced by management techniques, particularly burning and grazing (Wright & Westerhoff, 2001), which, at appropriate levels, create the most diverse sward composition and structure. A lack of management results in the dominance of Purple Moor-grass to the detriment of other species (and eventually succession to scrub and woodland), while over-burning can lead to the dominance of Heather and loss of bog-mosses (Rodwell, 1991)
- 1.120 Artificial drainage that lowers the water table reduces the growth of bog-mosses and can lead to the spread of Bog Myrtle *Myrica gale* and European Gorse *Ulex europaeus*. Stands in good condition have about 25% heather cover, with at least 20% cover of bog-mosses and not more than 50% cover of Purple Moor-grass distributed amongst the sward.

Wet heath descriptions

- 1.121 The four Wet Heath communities found in the New Forest are described here. Vernacular names are used where these are in common usage.
- 1.122 The most widespread and typical type of Wet Heath is characterised by Cross-leaved Heath, Purple Moor-grass, Deergrass and small Bog-mosses (*Sphagnum tenellum* and *S. compactum*). Heather is a common component of the sward, but is never dominant as it often is in dry heath. Lichens, particularly the wet heath specialists *Cladonia strepilis* and *Pycnothelia papillosum*, can be frequent.
- 1.123 Tussock Heath is found on more base-rich soils and is correspondingly richer in species, with Devil's-but Scabious *Succisa pratensis*, Meadow Thistle *Cirsium dissectum*, Saw-wort *Serratula tinctoria* and less common species such as

Marsh Gentian *Gentiana pneumonanthe* and Petty Whin *Genista anglica*. It tends to lack the more acid-loving species such as Deergrass, Bog Asphodel and Common Cottongrass, and the typical bogmosses are often replaced by *Sphagnum auriculatum*. A particularly calcareous form not described in the NVC but sometimes called Calcareous Tussock heath (Wright and Westerhoff, 2001) is found very locally in the New Forest.

- 1.124 A third type of Wet Heath is found in wetter hollows where the cover of heathers and Purple Moor-grass is reduced and Deergrass and Heath Rush are found together with more extensive carpet of bogmosses. Runnels and hollows support sundews, typically Round-leaved Sundew *D. rotundifolia* and also Oblong-leaved Sundew *Drosera intermedia*. Bare peat can support Marsh Clubmoss *Lycopodiella inundata* and Brown-beak Sedge *Rhynchosphora fusca*, both nationally scarce species.
- 1.125 Humid Heath tends to be intermediate in character between typical Wet Heath and the more humid dry heath community typified by Dwarf Gorse *Ulex minor* and Bristle Bent *Agrostis curtsii*. It is characterised by heather, Cross-leaved Heath, Purple Moor-grass and the distinctively globular moss *Leucobrium glaucum*. Bog-mosses are absent.

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