INVERTEBRATE CONSERVATION IN GREAT BRITAIN

No. 2: NORTH-EAST ENGLAND

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FOREWORD

Between 1988 and 1992 I was employed by the Nature Conservancy Council (NCC) to produce reports that summarised the information collated by the Invertebrate Site Register for each NCC Region of Britain. The aim was to draw attention to the key habitats and species of each Region and to highlight the more significant local sites for invertebrate conservation. The project required an extensive programme of site visits within each Region to discuss management issues, to gain an overview of biogeographical differences, and to take photographs of salient features to illustrate the reports. In the first three years of the project I visited almost 500 sites, covering every county in England and Wales (I didn't have time to get to Scotland), but then politics intervened. The dissolution of NCC, and its break-up into the Country Agencies of English Nature, Scottish Natural Heritage and the Countryside Council for Wales, meant that the project had to be curtailed and I spent the final year completing the writing up of the reports for the areas already visited. However, subsequent changes to the Regional structure in England had the effect of making the English reports less pertinent and English Nature decided to abandon their publication. The report for Wales was published in 1994 (Fowles, A.P. 1994. *Invertebrates of Wales: a review of important sites and species*. Peterborough, Joint Nature Conservation Committee).

Whilst the geographical focus no longer fitted with the new administrative regime, it was a great pity that all of this work had to be discarded and so, nearly a quarter of a century on, I've decided to resurrect the three original manuscripts that survive. Much has changed in our understanding of the priorities for invertebrate conservation in the 24 years since this draft was written, but many of the basic principles are just the same. There will be more information on a wider range of key sites in these areas nowadays and the conservation status (and nomenclature) of many species will be different, but as a general introduction to the invertebrate interest of England there is perhaps some value in making the drafts more widely available. My selection of images to accompany the text is much reduced and what remains is a handful of scans from twenty-five year-old slides that fail to do justice to the features and landscapes I saw, but I include them here as part of that historical record.

The Invertebrate Site Register was established by the Nature Conservancy Council in 1980 to collate information from a variety of published and unpublished sources, with the principal aim of identifying and evaluating sites of importance for the conservation of non-marine invertebrates in Great Britain. Whereas it is undoubtedly true that overall species-diversity is at its greatest in Southern England, chiefly due to climatic factors, it is also clear that other areas of Britain also contain nationally important sites or species as a result of regional variation in land use, geology, climate or habitat distribution. These regional accounts are an

attempt to describe the particular aspects of each area which are of major significance for the conservation of invertebrates, by drawing attention to species, communities or micro-habitats which exemplify the strengths, in invertebrate terms, of the individual regions. The following account of invertebrates and their conservation in north-east England is based upon the Regional information compiled for the Nature Conservancy Council's Invertebrate Site Register. This was collated into a series of reports in 1986 and 1987 by Dr Stuart Ball and Dr Roger Key:

Invertebrate Site Register - Report number 65. Review of Invertebrate Sites in England. Review of Humberside.

Invertebrate Site Register - Report number 68. Review of Invertebrate Sites in England. Review of Cleveland.

Invertebrate Site Register - Report number 69. Review of Invertebrate Sites in England. Review of Durham.

Invertebrate Site Register - Report number 70. Review of Invertebrate Sites in England. Review of Tyne and Wear.

Invertebrate Site Register - Report number 71. Review of Invertebrate Sites in England. Review of Northumberland.

Invertebrate Site Register - Report number 77. Review of Invertebrate Sites in England. Review of North Yorkshire - East.

Invertebrate Site Register - Report number 78. Review of Invertebrate Sites in England. Review of North Yorkshire - Central.

Invertebrate Site Register - Report number 79. Review of Invertebrate Sites in England. Review of North Yorkshire - West.

INTRODUCTION

The Region of North-east England, as administered by the Nature Conservancy Council (NCC), extends for more than 200 kilometres from Grimsby in the south to the Scottish border, and is bounded to the west by the high ground of the Pennines. This vast area comprises the modern counties of Northumberland, Tyne and Wear, County Durham, Cleveland, North Yorkshire and Humberside. Land use is extremely varied over this geographically diverse area but is essentially dictated by the expediencies of topography and agricultural productivity. A high proportion of the Region is upland in character and these districts are generally sparsely populated with a pastoral economy dependent upon sheep and cattle grazing as the major agricultural activities. Some areas, most notably in Northumberland's Kielder Forest, have been extensively planted with conifers. Urban centres are concentrated along the coast or the major river valleys and heavy industry is associated chiefly with the larger estuaries, as at Newcastle, Middlesbrough and Kingston-upon-Hull. These lowland areas have seen the greatest loss of semi-natural habitats as a result of urbanisation, industrial expansion, and agricultural improvement. The productive soils of Humberside and the Vale of York, in particular, have been exploited for arable cultivation, although this is by no means confined to the south of the Region.

The influence of solid geology upon the distribution of invertebrates and other organisms is a major aspect in the conservation of our native flora and fauna and the range of geological formations present in North-east England contributes significantly to the diversity of its invertebrate fauna. Of particular importance is the prevalence of calcareous bedrock running as bands across much of the Region. In the south-east, the Cretaceous Chalk of the Lincolnshire and Yorkshire Wolds is the northernmost outcrop of chalk in Britain. Much of this is masked by glacial drift but several important conservation sites occur where unimproved chalk grassland survives on the steeper slopes of the Wolds. To the north of this, the Jurassic Sandstone plateau of the North York Moors, with its incised glacial valleys, supports extensive tracks of heather moorland. The sandstone overlies Jurassic Limestone and, where the valleys have cut down into this, many base-enriched woodland and grassland sites of conservation value occur. Extending as a narrow band through the centre of Yorkshire from North Lincolnshire and on into County Durham, is Magnesian Limestone. This has many features of interest along its length and between Hartlepool and Tynemouth it forms a rich coastline with important stretches of calcareous cliff grassland. Further west, the Pennine districts of the Yorkshire Dales, Teesdale and Weardale are composed largely of Carboniferous Limestone. In Yorkshire this has produced the fascinating limestone pavements and the high peaks of Whernside, Ingleborough, Pen-y-Ghent, etc., some of which are capped by acidic Millstone Grit. In County Durham, the intrusion of volcanic rocks

along the Whin Sill fault metamorphosed the Carboniferous Limestone into a crystalline form ('sugar' limestone) and, where this is exposed on the high plateau of the Durham Fells, rare montane invertebrates are found in association with an arctic-alpine flora. The most important geological formation in Northumberland is the Devonian Sandstone which forms the Cheviot Hills. They rise to 813 metres a.s.l. and, like the North York Moors, are mainly covered by dry moorland, but at higher altitudes, and in the damper climate of the west, there are extensive areas of blanket mire. Elsewhere in Northumberland, the Carboniferous bedrock is smothered by glacial deposits and the influence of these rich limestone and Coal Measures rocks is only locally evident in the river valleys and on coastal cliff sections.

The glacial history of North-east England is obvious throughout most of the Region and its landscape has been dramatically shaped by the events of the last Ice Age. The creation of the numerous valleys and the sculpturing of the high ground has provided the framework on which the present-day vegetation has developed but there are also many important habitats which have arisen on the glacial deposits left behind in the wake of the ice. The Coversands of South Humberside and the Vale of York, laid down about 10,000 years ago, were formerly covered by an extensive area of dry heathland but much of this has been agriculturally improved. A few exceptional sites survive, however, and these are of national importance with substantial biogeographical interest. Sadly, little now remains of the semi-natural habitats of the boulder-clays of the Holderness plain north of the Humber. This was once peppered with glacial depressions filled with lakes and rich fens but only Hornsea Mere (and the degraded fen of Roos Bog) has survived the intensive drainage of the area. Further north, the kettleholes of Northumberland are a further legacy of glaciation and some of those which have remained intact have developed important mire communities with relict invertebrate faunas. The alluvial sands in the basin of an ancient lake in Northumberland are another example of important periglacial deposits as these now form the banks of the River Till, an outstanding site for riparian invertebrates.

On top of this geological and geomorphological background Man has also shaped the habitats of North-east England with his cultivation of the land and his development of towns, cities and industries. In modern times, this exploitation has usually been to the detriment of wildlife but in one regard these activities have been beneficial; the creation of secondary habitats, some of them long-established, arising from the extractive industries. In the pursuit of coal, limestone, chalk, clay, sand and gravel, Man has left behind a series of neglected pits and quarries that nowadays support pools, fens and grasslands of increasing importance to conservation. Many of these sites were abandoned at a time when adjacent habitats were largely semi-natural and hence colonisation of these sites was possible by a whole spectrum of plants and animals typical of the surrounding countryside. The sand and

brick pits of Humberside, the chalk and limestone quarries of Yorkshire and County Durham, and the subsidence ponds of the Northumbrian Coal Measures all contain examples of important sites for invertebrate conservation in areas where much of the semi-natural habitat has long since disappeared.

Of course, it is not only artificial habitats that are important for nature conservation in North-east England and there are several semi-natural habitat-types that are of national significance for the conservation of invertebrates. The Region's coastline has perhaps suffered more than any other habitat in terms of damage to its features of wildlife interest but there are, nonetheless, some quality sites remaining. In a Regional context, there is a scatter of valuable sites along the whole length of the coast, notably the northern dunes and the soft rock cliffs of the Scarborough District of North Yorkshire. The complex of habitats on the Spurn peninsula is also of considerable interest, although natural erosion has destroyed some of the best sections and up-to-date information is needed to determine its current importance. The areas of coast in North-east England which are of the greatest significance for invertebrate conservation are probably the Magnesian Limestone cliffs of County Durham and the estuarine reedbeds of the Upper Humber. The limestone grasslands are relatively under-worked but the widespread occurrence of a distinctive assemblage of scarce moths and butterflies is well known. The Durham Argus *Aricia artaxerxes salmacis* has some of its strongest colonies here and most of the British population of the least minor *Photedes captiuncula* breeds on these damp, calcareous cliffs. The Humber marshes similarly contain a number of species which have a restricted distribution nationally, the ground beetle *Dromius sigma* for instance, and their range of brackish and freshwater conditions supports a diverse fauna of uncommon invertebrates.

The woodland habitats of North-east England are very varied although most of the ancient, semi-natural woods are situated on steep valley sides. Their faunas vary according to their geology, humidity, aspect and site history and, in total, represent a major contribution to invertebrate conservation. Castle Eden Dene is the best-known example; its mixed woodlands in a deep, limestone gorge support an extensive fauna which has been historically well-recorded. However, the most outstanding woodland site in the Region is unquestionably Duncombe Park, a relict of the ancient Forest of Ryedale in North Yorkshire. The abundance of mature and over-mature trees on this Eighteenth century deer-park sustains an exceptional deadwood fauna with many species otherwise restricted to the pasture-woods of southern England. Lowland grasslands of conservation interest are relatively scarce but good examples occur on the Chalk Wolds and the Jurassic and Magnesian Limestone. A feature of the calcareous pastures is the richness of the fauna associated with rockrose *Helianthemum* chamaecistus. The flood meadows of the Derwent

Ings are one of the few areas of unimproved wet grassland in the Region and surveys indicate that they are of great significance for many groups of wetland invertebrates. Recent surveys of the Ings meadows have confirmed that they are of national importance.

Few areas of lowland heathland have survived agricultural improvement and afforestation but three exceptional sites remain. In the Vale of York, Skipwith and Strensall Commons are large tracts of heathland with a mosaic of wet and dry communities. In addition to the representative fauna of heathland invertebrates they also have interesting species present on willow and birch scrub. Scrub encroachment must obviously be held in check but, with nationally important populations of scarce vapourer *Orgyia recens* and dark bordered beauty *Epione parallelaria* moths, scrub control must be managed carefully. South of the Humber, Risby Warren on the Lincolnshire Coversands is a large area of dry grass-heath with inland sand dunes. Several species which are characteristic of the East Anglian Brecklands have been found here and it is regarded as the best example of dry heath in Northern England for invertebrates.

The upland marl lake of Malham Tarn is the most important body of standing water in the Region and is also outstanding in national terms. There are many invertebrates of note associated with its lime-rich waters, although one species, the flightless caddisfly *Agrypnia crassicornis*, is particularly significant as it occurs here in its only British locality and is also extremely rare throughout Europe. The clean rivers and streams of upland districts across the Region are a valuable resource for freshwater invertebrates, including the native crayfish *Austropotamobius pallipes*. However, of greater conservation interest are the deposits of sand and shingle alongside some of the rivers of Northumberland and North Yorkshire. They support an assemblage of beetles, flies and spiders which are nationally scarce and several of these are very rare outside North-east England.

The area of lowland peat in the Region has been dramatically reduced from its former extent, particularly on the mires of the Humberhead Levels. Most of the surviving peat of the Levels is in South Yorkshire but Crowle Waste, on the edge of Thorne Moors, is an important remnant with an excellent raised mire fauna. Old peat-cuttings here are one of only two British sites for the ground-beetle *Bembidion humerale*, a rare European species which is entirely confined to ombrotrophic mires. The valley fen of Askham Bog is another peatland of national significance. Its fauna shows strong affinities with the fens of East Anglia and much of this interest is currently associated with the well-developed carr woodlands which dominate the site. In Northumberland, the outstanding peatland locality is Newham Fen, a eutrophic basin mire with a strong colony of dark bordered beauty moths and considerable potential for other important discoveries.

Selecting highlights from amongst the upland habitats of North-east England is more difficult as only a small number of sites have been adequately surveyed. The high summits of mountains such as Ingleborough and Pen-y-Ghent have produced interesting records of montane invertebrates but it is not known how restricted many of these species are likely to be. The occurrence of the arctic-alpine relict whorl snail *Vertigo genesii* on Widdybank Fell, its only known station in Britain, is possibly of greater significance as the unique environment of Upper Teesdale probably accounts for the presence of this and other rare upland invertebrates. The limestone habitats of the Yorkshire Dales are also noteworthy, particularly the ashwoods of the limestone pavements. They contain a characteristic mollusc fauna with two species, the snails *Clausilia dubia* and *Vitrea subrimata*, which are peculiar to the Carboniferous Limestone of North Yorkshire and South Cumbria. Limestone pavement is also present at Malham Tarn, though it is the Tarn and the adjacent upland peatlands which are of especial interest. The juxtaposition of the raised mire of Tarn Moss and the calcareous Tarn Fen, both of which support rare and interesting faunas, is an unusual feature and the combination of habitats in the unique setting of Malham makes this a site of unparalleled importance for nature conservation.

The Nature Conservancy Council's North-east England Region covers the Watsonian vice-counties of South-east Yorks (VC61), North-east Yorks (VC62), part of Mid-West Yorks (VC64), North-west Yorks (VC65), Durham (VC66), South Northumberland (VC67), North Northumberland (VC68) and the Humberside parts of North Lincs (VC54) and South-west Yorks (VC63). Biological recording in the Region has largely been governed by these boundaries in the past and are still regarded by many naturalists as convenient geographical units.

There is a long history of invertebrate study in North-east England and parts of the Region are amongst the best known areas of Britain. This tradition extends back to the early Victorian era when many professional gentlemen began to document the faunas of specific areas. Although much of the early interest was shown in popular groups such as the Lepidoptera and Coleoptera, considerable work was also done on lesser-known Orders like the Hemiptera and Hymenoptera. Many of these Victorian entomologists left extensive insect collections which are still extant in the Region's museums and they offer a fascinating insight into the fauna of the time, as well as allowing for confirmation of species-identification in the face of subsequent taxonomic revisions.

The efforts of individual entomologists were soon coalesced into Naturalists' Field Clubs and the Berwick Naturalists' Field Club, formed in 1842, was the first of its kind in Britain. Many

others followed suit and were eventually amalgamated into the umbrella-bodies of the Northern and Yorkshire Naturalists Unions. These bodies published the journals 'Vasculum' and 'The Naturalist' respectively and many valuable articles on invertebrate distribution have been documented therein over the past century. South of the Humber, recording effort was administered by the Lincolnshire Naturalists Union and many interesting papers were published in their 'Transactions'. Today there is a broad coverage of invertebrate groups in the Region and knowledge of the status of several Orders is at a very high level. Certain districts which are remote from the major centres of population are still poorly known but, on the whole, North-east England has been well-served by its amateur naturalists and the volume of information submitted to the Invertebrate Site Register is testament to their endeavours and enthusiasm.

In recent years, the contributions of local naturalists have been joined by the involvement of staff and students of the Universities at Newcastle, Durham, Hull and York. This has taken the form of county surveys of individual groups or more detailed ecological studies of sites or habitats. Much of our knowledge of upland peatland faunas is derived from one such study, for instance, and other valuable work has been done on the chalk grasslands and the effects of management on the North York Moors. Wardens of the NCC have also taken an active interest in invertebrate recording on their reserves and a major study of the effect on invertebrates of transplanting Magnesian Limestone turf is being undertaken by NCC scientific staff of the England Field Unit in County Durham. The County Wildlife Trusts have also made significant contributions to Regional knowledge of invertebrates with the initiation of detailed invertebrate surveys, monitoring studies on invertebrate populations under different management regimes on Trust reserves, and the publication of County Faunas.

There is an impressive breadth of invertebrate expertise amongst the naturalists of North-east England and the historical baseline of recording provides a sound background for the utilisation of this knowledge in the enhancement of invertebrate conservation in the Region. As outlined above, there are many outstanding sites with faunas which are of national importance. Some of these have been comprehensively surveyed whilst others are scarcely known and offer much scope for rewarding fieldwork. As the pressures on our natural environment continue to grow, there is a need to maintain the current high level of entomological activity and direct this towards those areas of invertebrate recording which have practical applications for conservation. There will always be threats to valued habitats but the continued co-operation between invertebrate zoologists and conservationists will ensure that the rich fauna of North-east England will survive.

COASTLANDS

Coastal habitats, by their very nature, are restricted in terms of distribution and extent. By the same token, any invertebrate species that are ecologically restricted to coastal habitats must necessarily be limited in their distribution. Hence, their conservation is dependent upon the maintenance of suitable habitat along the narrow coastal fringe. With few exceptions, most of the habitat-types found along the coast of Britain are maintained by natural processes and the activities of conservationists are required to limit the damage caused by Man rather than to sustain the plagio-climax communities that he has created. The coast of North-east England has suffered historically from the pressures of industrial and residential development, agricultural improvement, and increased recreational activity, and sites which are of major significance for nature conservation are now thinly spread. Despite extending for over 300 kilometres, and including the broad estuaries of the Humber and the Tees, few stretches of the coast can be regarded as being of notable importance for invertebrates. In part this is a product of the Region's geology and geomorphology as the sheer northern cliffs are inhabited by few of the interesting coastal invertebrates and the boulder-clay exposures of Holderness are, in general, eroding too fast to provide suitable conditions for the specialised fauna of soft-rock cliffs. The remaining sites of interest, many of them owned or managed as nature reserves by the various conservation organisations working in the Region, take on a heightened importance within this background and demand the most strenuous efforts towards their safeguard.

Sand dunes support a characteristic invertebrate fauna that includes many species which, because of their specialised requirements, are nationally scarce. The richest dune systems for invertebrates contain examples of the full dune succession as the increased variety of habitats naturally supports a greater range of invertebrate species. Within the dune succession there are a couple of features that are of especial importance: the presence of areas of bare (or sparsely vegetated) firm sand and dune slacks with a high water-table. Both of these features are present on the dunes of Lindisfarne off the Northumberland coast and this site has the potential of supporting an extremely valuable coastal fauna. Surprisingly, the area does not seem to have received the survey effort it undoubtedly deserves and only a few groups, particularly the Lepidoptera, have been adequately recorded. Several species of larger moths recorded on the Lindisfarne dunes are uncommon nationally, including the sand dart *Agrotis ripae* and the shore wainscot *Mythimna littoralis*, both of which feed on plants growing in the early stages of the dune succession. Amongst the dune-slacks, the rather scarce coast dart *Euxoa cursoria* has been described as being particularly common. Like many of the dune moths, the larvae of the coast dart feed at night on a variety of low-growing plants and burrow into fine sand during the day. The wetter slacks, particularly those which are slightly brackish, have produced records of flies such as *Nemotelus notatus*, *Lejogaster splendida* and *Dolichopus clavipes* which are restricted to coastal marshes. The current level of information is sufficient to indicate that the Lindisfarne dunes are a valuable site for invertebrate conservation but surveys are required for a broader range of groups to give a fuller picture of the site's importance.

On the adjacent mainland, Ross Links is another little-visited but highly promising dune system. The fauna is likely to be similar to that found on Lindisfarne and the results to date show that many of the interesting dune moths are indeed present. Records of several species of spider-hunting wasps (a group which is poorly represented in northern Britain) are also encouraging as they favour the open, sandy areas which are important for many dune invertebrates. Predatory flies, like *Philonicus albiceps* and *Thereva annulata*, which hunt and breed in such habitats, have already been recorded and more specialist inhabitants can be anticipated. Further south along the Northumberland coast are a number of smaller dune systems, such as Newton Links, which are subject to relatively high levels of public pressure. The resulting levels of erosion and disturbance will determine how significant these sites are for invertebrate conservation but some degree of interest will survive in all of them and appropriate visitor management can help to lessen the damage of recreational activities. On most of these sites noteworthy elements of the dune fauna will exist at low levels and by directing the public away from sensitive areas populations will recover.

The dunes either side of the Tees at Hartlepool in Cleveland also suffer from recreational erosion; however, both Coatham Sands and Seaton Sands retain much invertebrate interest. These dunes have been the focus of detailed entomological surveys and have been found to support a good range of dune specialists. The ground-beetle genus *Amara* is well-represented with a number of uncommon species present which are characteristically associated with sandy habitats, including *Amara lucida*, *A. spreta* and *A. praetermissa*. The lyme grass moth *Photedes elymi* has also been recorded here and at many other sites along the North-east coast. It occurs sporadically along the east coast of England and Scotland where, as its name suggests, it feeds on lyme grass *Leymus arenarius* growing in the yellow-dune zone.

There are no significant areas of wind-blown sand to be found anywhere along the coast south of Cleveland until the mouth of the Humber is reached. Here the curving shingle spit of Spurn Head, most of which is covered by a narrow but relatively tall band of dunes, juts out for six kilometres into the Humber estuary. The dynamic forces which gave rise to this extraordinary site are now beginning to work against it and it is likely that the processes of natural erosion will eventually destroy Spurn altogether. Several sections of the peninsula which were classic entomological localities have been lost over the last twenty years and other habitat changes, due mainly to a reduction in the levels of rabbit grazing and the encroachment of sea buckthorn scrub, have also contributed to a decline in the invertebrate interest of the site. In addition to these problems, a severe oil spillage in the Humber in 1971 is believed to have caused the extinction of the uncommon strandline woodlouse *Armadillidium album* at its only known site in the Region. Nonetheless, Spurn presumably still supports a large number of scarce and interesting dune invertebrates, although there is little modern information available to assess its current importance. Species which have been recorded in recent years include the rare solitary bee *Coelioxys quadridentata*, which parasitises the leaf-cutter bee *Megachile willoughbiella*, and the linyphiid spider *Baryphyma maritima* which is found at only a handful of sites on the east coast of England where it lives amongst marram grass *Ammophila arenaria* in the foredunes. Historically, Spurn Head was recognised as supporting many invertebrates at the northern limit of their range on the east coast of Britain and there is modern evidence amongst the beetles, spiders and moths that an element of the southern fauna still persists. However, increased survey effort is required to establish the current importance of Spurn for invertebrate conservation and to assist with the guidelines for management of this increasingly threatened site.

At present, the saltmarsh on the west side of the Spurn peninsula is expanding and is well-structured with a good range of saltmarsh plants. This is an important addition to the

estuarine habitats of the Humber as so many important sites have been lost to reclamation and industrial development. The patches of saltmarsh which have survived are often small and threatened by pollution from a variety of sources. Few fragments of saltmarsh which are important for invertebrate conservation remain in the outer Humber and the conservation of the better examples should be seen as a matter of priority. Along the north bank, in addition to Spurn, there are only three significant areas of unreclaimed saltmarsh - Welwick, Stone Creek and Cherry Cob Sands. Cherry Cob is grazed and hence lacks the structural framework that is important for many species of saltmarsh invertebrates but nonetheless contains a number of interesting species, such as the nationally rare chloropid fly *Eurinia lurida*. Welwick and Stone Creek are better developed with a diverse flora which provides host-plants for several scarce saltmarsh insects. The uncommon weevil *Polydrusus chrysomela*, for instance, feeds on sea wormwood *Artemisia maritima* at Stone Creek and the leaf beetle *Phaedon concinnus* (which is associated with sea arrow-grass *Triglochin maritimum* and other saltmarsh plants) occurs at Welwick. Along the upper saltmarsh, Roesel's bush-cricket *Metrioptera roeseli* and the lesser marsh grasshopper *Chorthippus albomarginatus* can be found, occurring here at their northernmost localities in Britain.

The Humber estuary above the Humber Bridge has suffered less from reclamation in the past and is fringed for many kilometres by linear saltmarsh which grades into estuarine reedbed in several places. The extensive reedbeds of Blacktoft Sands at the confluence of the Ouse and Trent are the largest example and have received most attention from entomologists. Typical saltmarsh ground beetles such as *Bembidion iricolor* and *B. maritimum* are frequent and the rare *Dromius longiceps* is a widespread inhabitant of the litter-layer amongst these Upper Humber reedbeds. Outside the Humber estuary this species is known only from the East Anglian fens of Norfolk and Cambridgeshire and the Humberside populations are, therefore, of national importance. There is considerable interest, too, amongst the reedbed Lepidoptera with nationally scarce species like the brown-veined wainscot *Archanara dissoluta* and the silky wainscot *Chilodes maritimus* feeding within the stems of common reed *Phragmites australis*. Less is known of the Dipteran fauna but the presence of the snail-killing flies *Colobaea bifasciella* and *Sciomyza simplex* (both of which are national rarities that prey upon semi-aquatic snails as larvae) serves to emphasise the importance of these estuarine habitats for invertebrate conservation.

Apart from the vegetated saltings and marshes of the Humber, the bare substrates of the intertidal flats also support a distinctive group of terrestrial invertebrates, particularly beetles which burrow into the sand or mud. The greatest threat to their conservation is probably the deterioration of water-quality in the estuary as it is likely that suitable

sediments for these highly-specialised species, including rove-beetles of the genera *Carpelimus* and *Diglotta*, will always be present. A much more localised and easily-damaged bare ground habitat is the section of low sandy cliffs that occur at places like North Ferriby. A characteristic assemblage of invertebrates is associated with such sites, many of which are nationally scarce because of the restricted distribution of suitable habitat. Of particular interest is a large colony of the very rare rove beetle *Bledius dissimilis*, a small species which makes burrows in the friable soils of vertical cliff-faces and which is known from only three localities in Britain.

Away from the Humber, estuarine habitats of conservation value are extremely limited in North-east England, industrial reclamation having destroyed most of the former saltmarsh in the other major rivers of the Region. Cowpen Marsh at the mouth of the Tees is a large area of saltmarsh grading into freshwater marsh to the south of Greatham Creek. The network of creeks and brackish ditches supports an interesting water beetle fauna which includes uncommon species such as *Agabus conspersus*, *Haliplus apicalis* and *Ochthebius marinus*. The typical saltmarsh spiders *Erigone longipalpis* and *Silometopus ambiguus* have also been recorded but most groups are poorly-worked and there is scope for much greater survey effort over the full range of invertebrate Orders. Tyne and Wear has lost practically all of its saltmarsh and the only decent remaining fragment is Timber Beach, which is situated on the north bank of the River Wear upstream from Sunderland. The fauna here contains a number of representative saltmarsh invertebrates but the site is too small to expect it to be of anything more than local importance.

The only other substantial area of saltmarsh on the coast of North-east England is established on the Holy Island Sands at Lindisfarne and Budle Bay. However, much of this is dominated by cord-grass *Spartina* sp. and the lack of structural variety is reflected in the paucity of the fauna. Small areas where there is plenty of sea aster *Aster tripolium* have proved to be the most productive, yielding typical saltmarsh flies like *Dolichopus diadema* and *Machaerium maritimae*. The sea aster itself is host to the scarce picture-winged fly *Paroxyna plantaginis*. Surveys of saltmarsh Lepidoptera have been rather fruitless but a large population of the saltern ear *Amphipoea fucosa* is present.

The remaining sites of importance for invertebrate conservation on the Region's coast are associated with the long stretches of cliffed coastline. Much of this is sheer with little maritime grassland and is generally of limited value for invertebrates, but sections of the Magnesian Limestone in County Durham produce low cliffs with numerous calcareous flushes and seepages. This area is probably best known for its colonies of the Durham argus butterfly *Aricia artaxerxes salmacis*, a subspecies of the northern brown argus. These colonies are usually established on sheltered slopes, often at the mouth of coastal denes, where occasional landslips maintain areas of broken ground and short turf grassland. The northern brown argus is a member of a distinctive assemblage of butterflies and moths found on calcareous grassland in both coastal and inland localities throughout North-east England. Other characteristic species include the cistus forester *Adscita geryon*, the chalk carpet *Scotopteryx bipunctata* and the least minor *Photedes captiuncula*. All of these species are of restricted distribution in Britain but the least minor is entirely confined to northern England and the colonies of the Durham coast represent a major stronghold for the species.

Other invertebrate groups are poorly worked on these coastal grasslands and yet the calcareous flushes are likely to support a number of interesting species that are of very local occurrence in Britain. Records of the scarce water beetle *Helophorus dorsalis* and the soldier fly *Oxycera pygmaea* from flushes at Seaham Bay give an indication of the potential and this area would be well worth surveying thoroughly for beetles and flies.

Soft-rock cliffs are the other coastal habitat of major significance for invertebrate

conservation in North-east England. Although there are relatively few stretches of coast that provide suitable conditions, sites like Cayton Bay near Scarborough are of considerable entomological importance as this is a rather scarce habitat in Britain as a whole. Cayton Bay contains good examples of cliff-top grassland and coastal woodland but it is the slumping boulder-clay cliffs that are of greatest invertebrate interest. Whilst landslips are frequent here, there is sufficient overall stability of the coastline to ensure continuity of the early stages of the development of maritime grassland communities. Thus, the cliff slumps expose bare clay which is gradually colonised by a sparse, pioneer vegetation. A herb-rich flora follows to provide nectar sources for many insects before fine grasses begin to dominate the sward and eventually form rank grassland. Landslips curtail this natural succession and maintain the rich mixture of open-ground conditions that supports the characteristic and highly-specialised fauna of soft-rock cliffs.

This fauna is at its richest, as at Cayton Bay, where numerous seepages flow down the cliffs, providing damp clay on the exposed faces and mossy flushes on the vegetated slopes. The jumble of broken clay and abundant crevices of the recent landslips provide shelter for predatory beetles which hunt over damp, bare ground, such as *Bembidion saxatile* and *B stephensi*. At Cayton Bay, and a few other sites along the Yorkshire coast, the ground beetle *Nebria livida* occurs exclusively in this type of habitat. It is a rare species which is confined to a handful of localities on suitable stretches of coastline in eastern England. The shallow margins of the vegetated flushes are inhabited by the larvae of semi-aquatic flies, many of

which are nationally scarce. Soldier flies, such as *Oxycera nigricornis* and *O*. *trilineata*, are typical species along with predatory dolichopodid flies like *Micromorphus albipes*. Craneflies and water beetles are other insect families which contain species found only in the flushes of semi-stable soft-rock cliffs but specific information is not available for the Yorkshire coast.

The importance of other sections of soft-rock cliff, at Filey and Robin Hood's Bay for instance, has still to be determined and there is plenty of opportunity for many exciting discoveries to be made. In view of the fact that many coastal habitats are of limited extent in North-east England, it is imperative that the conservation value for invertebrates of the remaining sites is assessed before any further deterioration of habitat-quality occurs. The Region contains several classic entomological localities along its coastline where a rich fauna has survived in the face of many pressures. However, there is a need to safeguard as broad a range of the undamaged sites as possible and to ensure that the continuing threats from industry and recreation do not diminish this richness any further.

WOODLANDS

In terms of species-richness, woodlands far exceed all other terrestrial habitats for the diversity of the invertebrates they are capable of supporting. This is chiefly due to the multi-dimensional complexity of woodland structure and the resultant enhancement of the range of niches available for invertebrates to occupy. From the ancient undisturbed soils of the woodland floor to the new buds of the high canopy, thousands of species co-exist by utilising specific micro-habitats that match their individual requirements. The life-history of many of these inhabitants is still largely unknown and there are no woods in Britain that can claim to have been comprehensively surveyed. There are, however, a number of features contained within wooded habitats that are of recognised importance for invertebrates and there has been sufficient recording within the Region to identify significant sites on the basis of the presence of these features and examples of the more specialised invertebrates that occupy them.

The commonest type of woodland in North-east England that is of recognised significance for invertebrate conservation is the valleyside oak or ashwood. Occurring on steep slopes that have prevented wholesale clearance for agriculture, in many parts of the Region these woodlands represent the last remnants of the ancient forests that once clothed the land. Generally speaking, they share the characteristics of being humid, receiving little direct sunlight at ground level, and containing an abundance of rotting, fallen timber. Where they occur, sunny clearings on south-facing slopes will favour a different range of invertebrates and these warm, sheltered glades should be maintained as an additional feature of conservation importance. Aspect, geology and altitude will also produce variations in the structure and composition of valley woods which are reflected in the invertebrate community present. Past management will have had a major effect upon the fauna but nowadays the steepest woods are almost entirely neglected and it is only the shallow valley woods that have been modified to any great extent by grazing or timber extraction. More serious changes have been brought about by widespread coniferisation and many valleys have been underplanted, confining native broadleaved woodland to fragments alongside watercourses.

It is the dark, humid nature of the valley woods that provides much of their invertebrate interest. In these conditions, bryophytes and fungi prosper, providing important micro-habitats for a host of invertebrates. Although some species may be restricted to certain types of fungi or particular growth-forms of mosses, relatively few are host-specific and it is the quantity rather than the diversity of the lower plant flora that is of greatest significance. The rare muscid fly *Mydaea maculiventris*, for instance, breeds in bracket fungi and has been found at Shipley Wood in the Tees Valley, Co. Durham. This site also has a strong population of the soldier fly *Oxycera pardalina* breeding amongst sheets of wet moss on a calcareous cliff face at one of its few known localities in Britain. Other groups that are well-represented in damp, shady woods include craneflies, fungus gnats, molluscs and rove beetles.

Invertebrate-rich valley woods are scattered throughout the Region but there are concentrations in certain areas where the topography is particularly favourable. Draining the slopes of the Cheviot Hills are a series of river valleys with fringing bands of deciduous woodland. They are invariably dominated by oak and birch with alders growing along the river banks. Good examples are found at College Valley and Harthope where the empid fly *Empis scotica*, a woodland predator, and other scarce upland species are a significant element of the fauna. The Tees probably has the best inland valley woods in Co. Durham but few sites have been well-worked for invertebrates. The large complex of Shipley and Great

Wood has received a few visits by entomologists which have indicated the potential importance of the area but much remains to be investigated. This is also true of other wooded river systems in the north, such as the Allen, Wansbeck and Coquet in Northumberland.

The coastal denes of the Magnesian Limestone in Co. Durham have been badly treated in the past through coniferisation and infilling but two systems, Hawthorn Dene and Castle Eden Dene, have largely remained intact. These sites combine the best features of the damp, shady valley woods with the added bonus of a calcareous substrate and a maritime climate, all of which contribute to an exceptionally rich invertebrate fauna. Castle Eden is the best-studied of the two sites and has long attracted the interest of entomologists. Its known fauna reflects both the diversity of habitats and the degree of recording, resulting in a long list of national rarities from many invertebrate groups. Castle Eden is an outstanding example but the importance to invertebrate conservation of other coastal denes should be widely acknowledged and efforts made to safeguard the remaining fragments.

Further south, the northern slopes of the North York Moors are drained by several wooded valleys of conservation interest. Kilton Beck is one of the best-known entomologically and has a rich fauna associated with its flushed slopes and mixed canopy but others, such as Beck Hole Woods, also have considerable potential. East of the Moors, in North Yorkshire, the River Derwent flows through the National Nature Reserve of Forge Valley which, along

with the contiguous Raincliffe Wood, has been studied over a long period. The area has a particularly rich molluscan fauna which includes a number of ancient woodland 'indicator' species like *Spermodea lamellata*, *Acicula fusca*, *Zenobiella subrufescens* and *Limax cinereoniger*. These woods formerly contained an excellent range of beetles associated with deadwood habitats but the extensive coniferisation of Raincliffe Wood has probably diminished some of this interest, although many mature and over-mature standing broadleaved trees remain at present. The woods are in need of survey to determine the current extent of the deadwood resource and the quality of its surviving fauna. Rarities recorded in the past included the attractive net-winged beetle *Pryopterus nigroruber*, a predator of small arthropods in rotting timber, and the scarce fungus-feeding beetles *Tetratoma desmaresti*, *Thymalus limbatus* and *Abdera flexuosa*. Raincliffe is also of considerable interest for its Lepidoptera, with colonies of the large red-belted clearwing *Synanthedon culiciformis*, welsh wave *Venusia cambrica* and Blomer's rivulet *Discoloxia blomeri* amongst others.

Overall, the valley woods on the southern edge of the North York Moors (which, for the most part, cut through the Jurassic Limestone) contain a richer fauna than their northern counterparts. One of the most important localities in this respect is Ashberry and Reins Woods near Helmsley. Here the mixed deciduous woodland is dominated by ash, wych elm and pedunculate oak with a varied shrub layer and ground flora. Ashberry shares an excellent deadwood beetle fauna in common with the nearby Duncombe Park (discussed below) and also has a series of calcareous flushes which are inhabited by several rare species of flies. On the open, lower slopes of the valley, mossy seepages contain the soldier fly *Oxycera dives* whilst the cranefly *Erioptera nigripalpis* breeds in shadier conditions on the edge of flushes within the wood. Many other scarce, wet woodland, Diptera amongst families like the Empididae, Dolichopodidae and Sciomyzidae are also present. The value of the Ashberry woods for invertebrates is enhanced by the floriferous grassland of the unimproved pastures in the valley bottom. This creates sunny wood-edge habitats in sheltered conditions and provides abundant nectar sources for adult insects.

To the west of the Jurassic Limestone, few of the valley woods of North Yorkshire have been surveyed adequately enough to be able to comment on their significance for invertebrate conservation until we reach the Carboniferous Limestone of the Yorkshire Dales. The remnant woodlands of the limestone pavement and valleysides are upland in character and many invertebrates are common to both situations. Variety is provided by aspect, management history and the degree of shelter. Two of the best examples are Colt Park Wood on Ingleborough and Grass Wood at Conistone. Colt Park is a mature ashwood perched on a linear band of limestone pavement on the eastern flanks of Ingleborough. The

absence of grazing permits a luxuriant ground flora to flourish and the deep grykes are mossy and humid. Large stands of giant bellflower *Campanula latifolia* are host to the rare and beautiful picture-winged fly *Platyparella discoidea* but the Diptera have not been well-studied at this site and many more exciting discoveries can be anticipated. Colt Park has an assemblage of molluscs that is typical of wooded limestone in the Craven Pennines and includes *Clausilia dubia* and *Vitrea subrimata*, both of which are restricted to this general area.

Grass Wood also has a similar snail fauna associated with its limestone screes and pavements. Although partly coniferised, this large area contains a valuable mixture of semi-natural habitats, showing a gradation from the ashwoods of the lower slopes to wood-pasture dominated by birch on higher ground. Many of the more interesting invertebrates recorded here have been found in transition zones between woodland and calcareous grassland, where there is warmth and shelter as well as an increased plant diversity. Phytophagous beetles are well-represented and there are also several scarce soldier beetles present, including *Rhagonycha translucida* and three species of *Malthodes*. Grass Wood has also produced a record of the rare harvestman *Trogulus tricarinatus*, a predator of snails in the leaf-litter of calcareous woodlands. This species is otherwise known only from sites in southern England and Wales and is indicative of the peculiar micro-climates that can occur in favourable situations in these upland limestone woods.

The significance of micro-climates in woodlands cannot be overstated as the distribution of the majority of the invertebrates within a particular wood is related to their specific requirements for temperature and humidity. Phytophagous species must obviously have the correct foodplants available and other environmental features, such as the presence of streams, decaying timber, or accumulations of leaf-litter, will be necessary for other species to occur. However, the precise situation of these woodland components will have a critical effect upon the ability of invertebrates to breed and prosper, such that a particular host-plant growing in the shade will support a different fauna from the same plant growing along a sunny woodland edge. Broad rides can extend edge habitats into the heart of dense woodland and are of particular benefit where, as is so often the case, woodland boundaries abut directly onto the inimical habitats of the modern agricultural landscape. Many species of woodland Lepidoptera favour sheltered rides for breeding and a characteristic inhabitant (although now much declined in range) is the broad-bordered bee hawk *Hemaris fuciformis*, which can be seen feeding at the flowers of bugle *Ajuga reptans* and other low-growing plants in late Spring.

The benefits of woodland rides are seen to their best advantage on sandy soils where bees and wasps are able to make their nesting burrows in the proximity of a profusion of nectar sources. Sandy habitats inland are a scarce resource nationally and, in general, wherever they occur they will support important invertebrate populations as long as there is sufficient open ground. Closed canopy woodland which has developed over sand has a limited potential for a specialised fauna but, where this is already established, ride-maintenance can sustain a considerable invertebrate interest. Skipwith Common, for instance, on the glacial sands of the Vale of York has areas of mature oak and Scots pine woodland which are of enhanced interest because of their network of rides and paths. Allerthorpe Common nearby has been extensively coniferised but the ride system is regionally important for its populations of heathland bees and wasps, including the nomad bee *Nomada robertjeotiana* which is a scarce cleptoparasite of the mining bee *Andrena tarsatum*. In contrast, Gibside in Tyne and Wear is in danger of losing the valued elements of its ride fauna as the conifer plantations alongside overshadow the sandy banks and herb-rich flora. This site was historically regarded as one of the finest entomologically in North-East England but coniferisation of the former oakwoods has taken its toll and only relict fragments on the steep banks of the Derwent and the tributary valley of Snipes Dene provide refuges for some of its rarer species.

The widespread planting of conifers has afflicted large areas of the Region and a great deal of semi-natural habitat of conservation value has been lost as a result. Conifer plantations are no substitute, in conservation terms, for the habitats they replace but, nonetheless, it

must be acknowledged that some invertebrates have benefited from their presence. The occurrence of European species which have colonised Britain in the wake of exotic conifers, such as the handsome hoverfly *Eriozona syrphoides* or the moth *Eupithecia abietaria*, is not of direct concern to the invertebrate conservationist but the spread of native species from their strongholds in the Scottish pine forests is of interest. Mobile colonists, like the bark beetle *Pityogenes quadridens* and the click beetle *Ampedus nigrinus* have considerably extended their range and the populations of some scarce species have undoubtedly been strengthened. This only applies to an opportunistic fraction of the fauna of the Caledonian pine forests, however, and conifer plantations can never be expected to replace the richness of those ancient woodlands.

Primary forests are no longer a part of the landscape of northern England and hence species which are dependent on the specialised niches of ancient trees are naturally rare. The threatened fauna of over-mature timber now finds its most suitable habitat on the parklands of our larger estates where, by accident or design, a high proportion of Britain's oldest trees survive. This is very much the case in North-east England as several ancient deer-parks and estates contain an abundance of over-mature trees of great stature and age. These private grounds are not always easy to gain access to for survey and there are many sites with unexplored potential in Northumberland, Co. Durham, and the area immediately south of the North York Moors.

The most outstanding locality for invertebrates associated with decaying timber in the Region is the Duncombe Park estate near Helmsley in North Yorkshire. This Eighteenth century deer-park is a relict of the Tudor Forest of Ryedale and the richness of its fauna is largely due to the long continuity of over-mature trees in this area. Although the Ryedale woods have long since been fragmented, Duncombe retains a considerable number of venerable trees of a variety of species. Oak, beech, ash and wych elm in excess of 200 years old are of greatest significance but there are also alders, limes and field maples of some antiquity that provide additional interest. A valuable feature of the park is the widespread profusion of flowering hawthorns which are an essential source of nectar for adult insects seeking to build up their energy reserves for reproduction.

Parkland trees benefit from their open situation by an increased growth-rate and hence tend to attain a more impressive stature than trees of the same age growing under closed-canopy forest conditions. This extra productivity and reduced competition strengthens root-systems and assists individual trees to withstand internal decay and wind-damage. As a result, old parks often contain many half-dead trees which can continue to support deadwood invertebrates for centuries by providing a continuum of the micro-habitats on

which they are dependent. The multiplicity of niches thus created encourages a diverse fauna and enables species with very specialised requirements to find enough breeding sites to maintain a viable population. For instance, Duncombe Park is home to the bumble-bee mimic *Pocota personata*, a rare southern hoverfly whose larvae develop within the rot-holes of ancient beeches. This species is more or less restricted to the large beech woods of southern England but there are sufficient beeches of the right condition in Duncombe to sustain a relict population. The variety of the deadwood resource is also manifested in the diversity of longhorn beetles, with at least twelve species present and probably more to be discovered, an extraordinary assemblage so far north. They include the rarity *Leptura sexguttata*, a black and orange beetle which breeds in the deadwood of oaks and beeches. *Saperda scalaris*, a striking green and black longhorn, occurs here and at several other localities in the Region and is probably commoner in North-east England than elsewhere in Britain.

A unique feature of Duncombe Park is the remarkable occurrence of the flower-beetles *Ischnomera cinerascens*, *I. sanguinicollis* and *Oedemera virescens* together at one site. The larvae of these metallic-green beetles develop inside rotting deadwood, where they are probably predators on small arthropods, although the adults are pollen-feeders favouring hawthorn and umbellifer blossom. *I. cinerascens* has been found at Moccas Park in Herefordshire but is probably now confined to Duncombe, whilst the other two species are found in only a handful of the better deadwood sites in England. Their presence at Duncombe highlights the exemplary features of the park; ancient trees left undisturbed in their senility coupled with a profusion of nectar in the unimproved grasslands and thickets. There are lamentably few sites nationally which can match these qualities and Duncombe's future management should reflect its importance as one of the finest sites in Britain for deadwood invertebrates.

LOWLAND GRASSLAND

As with most Regions of England and Wales, lowland habitats with agricultural potential in North-east England have been steadily improved, leaving only isolated refuges of semi-natural vegetation amongst the modern farming landscape. Traditionally-managed meadows and pastures have become increasingly scarce and it is only in upland districts, like Teesdale or the Yorkshire Dales, that floriferous grasslands have survived in sufficient abundance to give a hint of the conditions that prevailed across much of the Region in the early years of this century. Nowadays, lowland grasslands of conservation interest are to be found chiefly in situations which have been the least economical to improve agriculturally. This, almost invariably, means either steep valley slopes unsuited to the plough or the stony floors of abandoned mineral quarries. Waterlogging has rarely dissuaded attempts to drain grasslands on the heavier soils and there are very few lowland sites that are of recognised entomological significance for their wet pasture fauna. Finally, there are the heathlands of the Vale of York and the Lincolnshire Coversands which contain substantial areas of dry acidic grassland, but these are best regarded as grass-heaths and as such are considered in the following chapter.

The glacial history of the Region has left a legacy of meltwater channels and it is the steep-sided slopes of these features that support most of the invertebrate-rich grasslands of

North-east England today. These sites are concentrated on the calcareous formations of the Magnesian and Jurassic Limestones and the Cretaceous Chalk of the Yorkshire Wolds. Apart from a handful of well-studied sites, information on the invertebrate faunas of such grasslands is scant but it is apparent that there are a suite of species that are characteristic of the better sites and which occur widely on each of these rock-types.

Lepidoptera have been recorded more comprehensively than any other invertebrate group and there is a distinctive assemblage of nationally uncommon species which are reasonably widespread in the Region. The northern brown argus *Aricia artaxerxes* is a typical inhabitant of sheltered, calcareous grasslands with an abundance of the larval foodplant, common rockrose *Helianthemum chamaecistus*. As on the coastal Magnesian Limestone grasslands of Co. Durham, the nationally scarce cistus forester *Adscita geryon* is often found on sites with colonies of the northern brown argus as it shares the same foodplant. The grass moth *Crambus pratella* feeds at the base of grasses growing in short turf on dry substrates, it is not common nationally but is well-distributed in suitable habitats in North-east England and can be anticipated to occur on most of the unimproved chalk and limestone grasslands in the lowlands. Another moth, the least minor *Photedes captiuncula*, is a speciality of the Magnesian Limestone but prefers damper sites where there is an abundance of glaucous sedge *Carex flacca*, on which the larvae feed. It is relatively scarce inland, favouring flushed coastal slopes, but is known from a few of the valleyside grasslands in Northumberland and Co. Durham. Elsewhere in Britain, the least minor is restricted to the Carboniferous Limestone of the northern Pennines and adjacent areas of Cumbria and North Lancashire.

The valleys of the Jurassic Limestone between Hartlepool and Scarborough support a small number of colonies of the very localised Duke of Burgundy fritillary *Hamearis lucina*. This charming butterfly favours calcareous grassland on the edge of scrub and as such its colonies are perpetually under threat of being shaded out by the encroaching bushes of gorse *Ulex europaeus* and hawthorn *Crataegus monogyna*. Formerly there would have been sufficient areas of suitable habitat for the butterfly to move into as the scrub advanced but this is no longer possible with the current isolation of unimproved grassland sites. Management of the remaining colonies of the Duke of Burgundy fritillary now demands vigilance to ensure that the balance between scrub-edge and open grassland remains favourable. It is a species of lightly-grazed or ungrazed grassland where the females seek out large-leaved plants of cowslip *Primula veris* on which to lay their eggs. Manual removal of encroaching scrub is, therefore, regularly needed to create suitable habitat-mosaics.

Tall calcareous grassland is also the preferred habitat of the marbled white butterfly *Melanargia galathea*, which reaches its northernmost limit in Britain on the chalk of the

Yorkshire Wolds. It is very localised but there is some indication that it is colonising abandoned chalk quarries with a sheltered, southerly aspect. The increase of arable farming in the Yorkshire Wolds means that some sites which were previously grazed are now neglected. This will benefit rank grassland species, like the marbled white, in the short-term, but will threaten populations of invertebrates requiring the warmer micro-climates of short turf. Eventually, the neglected grasslands will become scrubbed-over and most of the special interest of the calcareous pastures will be lost.

The fragmentation of unimproved grasslands that has put Duke of Burgundy fritillaries in such a perilous position will undoubtedly cause the extinction of many other, less conspicuous, invertebrates in the Region. Abandoned quarries offer potential habitats for the more mobile species (marbled whites, for example) and several contain important populations of scarce calcicolous invertebrates. Many of these quarries will have become disused at a time when adjacent grasslands were unimproved and such sites will support a representative fauna of the habitats that have disappeared around them. There are a number of old quarries in North-east England which are of conservation value, chiefly on the Magnesian Limestone of Co. Durham and the Cretaceous Chalk of the Yorkshire Wolds. In Durham, Bishop Middleham Quarry is a good example with populations of the uncommon snails *Helicella itala* and *Pupilla muscorum* and a strong colony of the Durham argus butterfly. Wingate Quarry, despite problems with motorbike scrambling, also has considerable potential.

The Yorkshire chalk quarries have been more thoroughly studied and some sites have a well-documented fauna. The best-known of these is Wharram Quarry, which has been the subject of ecological research by the Universities of Hull and York. Chalk scree and pioneer grassland communities have provided most of the more interesting records from this site, including several scarce weevils that favour these open-ground conditions, such as *Omias mollinus*, *Trachyphloeus aristatus*, *Sitona lineelus*, *Orthochaetes setiger* and *Brachysomus echinatus*. These conditions also suit ground-active predators like the carabid beetle *Licinus depressus* and the spiders *Alopecosa cuneata* and *Euophrys aequipes*, although in general the calcareous grasslands of the Region are of less significance for these groups than similar habitats in Southern England. The floristic richness of calcareous grassland naturally supports a diverse fauna of herbivores and, as with the Lepidoptera, there are a number of phytophagous beetles which are nationally uncommon but which occur widely in North-east England. Common rockrose is a foodplant for a surprising diversity of invertebrates and sites containing an abundance of rockrose can be anticipated to support an interesting fauna. The leaf-beetles *Aphthona herbigrada* and *Mantura matthewsi*, the pollen-beetle *Meligethes brevis* and the seed-beetle *Bruchidius cisti* all feed on rockrose and *M*. *brevis* is a

speciality of the Region. *Cryptocephalus aureolus*, which feeds on buttercups *Ranunculus* spp., is another widespread species on the chalk and limestone grasslands of the Region but which is a scarce species nationally.

In contrast to the situation occurring on the calcareous grasslands, the few remaining wet meadows and pastures have a high proportion of interesting predators amongst their fauna. This is particularly true of sites that contain pockets of bare mud amongst the grassland sward, allowing predators to move around easily in search of their prey. Wet grasslands that are partially tussocky in nature are of the greatest value as invertebrates can escape rising water-levels by climbing up into the tussock. These conditions occur in many places on the Derwent Ings, where the winter-flooded meadows are an extremely important habitat for invertebrates. Ground-beetles are well represented with records of such uncommon species as *Agonum livens*, *Blethisa multipunctata*, *Chlaenius nigricornis*, *Pterostichus anthracinus* and *P. gracilis*. Marshland rove-beetles known from this area include several scarce predators and generalist scavengers like *Platystethus nudifrons*, *Stenus carbonarius*, *S. europaeus* and *S. nigritulus*. Other notable species include the empid fly *Bicellaria mera*, the mirid bug *Capsus wagneri* and the snail-killing fly *Sciomyza simplex*, whose larvae are parasitoids of wetland molluscs. The interest of these wet grasslands is maintained by a high water-table and winter-flooding, allowing the early stages of many of the above-named species to develop amongst the damp soils.

Elsewhere in the Region, wet grasslands of known entomological value are extremely scarce and consist chiefly of small unimproved pastures alongside the numerous rivers and streams. Sites such as Watersmeet on the banks of the Tyne in Northumberland have produced records of several uncommon invertebrates but more work needs to be done to be able to evaluate the full extent and significance of the resource. Damp pastures situated on poorly-drained ground away from the rivers are even rarer and only Arcot Hall in Northumberland has sufficient information for it to be regarded as significant for its invertebrate fauna.

The status of some groups, particularly the more popular families amongst the Coleoptera and Lepidoptera, is reasonably well-known on the unimproved lowland grasslands of North-east England but scope for further survey exists amongst a wide range of invertebrates. In view of the rarity of such habitats in the Region, detailed surveys are required to identify sites which have a representative fauna. Whilst the continuance of traditional forms of management should largely sustain the overall quality of the remaining unimproved grasslands, invertebrate zoologists can materially assist in their conservation by highlighting specific site features which are of particular significance. In this way, gradual but deleterious

changes in habitat structure can be prevented and invertebrate richness on these sites safeguarded for the future.

LOWLAND HEATHLAND

Throughout western Europe, the extent of lowland heathland has declined dramatically over the past two hundred years and the conservation of the surviving heaths and their wildlife is an international concern. Although these habitats were largely created as a result of primitive forms of agriculture, they have developed a distinctive community of plants and animals that is now dependent upon the continued existence of the remaining, often fragmented, sites. In Britain, many of our rarest invertebrates are confined to the lowland sandy heaths of southern and eastern England and we have a European responsibility to ensure that their habitats are safeguarded and maintained.

There are two main concentrations of lowland heath in North-east England. To the north of the Humber estuary lie the acclaimed Vale of York heaths with three outstanding, well-studied, localities. South of the Humber are the Lincolnshire Coversand heaths which are potentially of great importance but which, with the exception of Risby Warren, are relatively little known and worthy of further attention. Elsewhere in the Region, lowland heaths are virtually absent, although Heseldon Moor West and Waldridge Fell in Co. Durham contain areas of mixed wet and dry heath that are of local significance for invertebrate conservation despite the heavy recreational pressures they experience. The heathland of North-east England accounts for only a small proportion of the total resource in Britain but,

nonetheless, is an important geographical outlier with an excellent invertebrate fauna. Appropriate management of the surviving heaths is essential and the re-instatement of heathland vegetation to suitable localities in the Region should be a major consideration of the local conservation organisations.

There are six remaining examples of the Vale of York heathlands that retain elements of the heathland invertebrate community. Two of these sites, however, are either too small (Tilmire) or have been too detrimentally affected by extensive birch scrub invasion (Pilmoor) to be of national significance for invertebrate conservation in their current state. Pilmoor has been drying out for decades, perhaps as a result of the drainage of surrounding land, and birch scrub has more-or-less replaced the valuable tracts of wet heath that once covered large areas of the site. Pockets of heath still survive, however, and the gradual, if labour-intensive, removal of scrub could help to restore much of its former interest.

The other four sites have all had their problems in the past but retain sufficient areas of unmodified heath to be of considerable value for invertebrates. The district around South Cliffe Common has lost much of its heath through conversion to arable but a valuable mosaic of rabbit-grazed heaths, small mires and mature birch woodland remains. Allerthorpe Common has been extensively planted with conifers and the trees are slowly drying out the patches of wet heath which escaped coniferisation. However, the broader rides here are maintained in a manner which is compatible with invertebrate conservation and the ride fauna contains an important heathland element. Strensall Common also has plantations of both oak and Scots pine but these affect only a fraction of the total area of almost 600 hectares. Frequent, accidental fires have restricted birch invasion on Strensall Common and the Ministry of Defence (who own most of the Common) carry out their training activities at levels which are beneficial to invertebrate conservation by occasionally creating stretches of bare sand. Part of Skipwith Common was turned into an aerodrome during the Second World War, although dry heath has now colonised the edges of the old runways. Restoration (by the Yorkshire Wildlife Trust) of traditional grazing practices elsewhere on this reserve is a welcome step towards the management of this nationally important site.

In general, the Vale of York heaths are highly acidic and the paucity of nutrients has contributed to the development of shallow peats and the formation of wet heath communities. Natural depressions and peat-cuttings occur on all of the better sites and contain small pools or basin fens which add to the habitats available for the wetland members of the heathland fauna. Pockets of *Sphagnum* on the wet heaths are inhabited by the local bugs *Lamproplax picea* and *Hebrus ruficeps* and the moist carpets of moss also

support several uncommon species of beetles and money-spiders. Both Skipwith and Strensall Commons are outstanding arachnological sites, containing many heathland specialists. Orb-weavers are particularly well-represented with *Hypsosinga albovittata*, *H. pygmaea* and *Singa hamata* amongst the more notable species. They build their webs in tall clumps of grass or amongst the twigs of heather *Calluna vulgaris* or cross-leaved heath *Erica tetralix* and require fairly mature phases of the heathland cycle. An important aspect of lowland heaths, wet or dry, is the presence of shallow, often seasonal, pools. These contain a number of scarce invertebrates which thrive in the absence of predators, such as fish, associated with permanent water-bodies. The water beetle fauna is a good example with such species as *Acilius canaliculatus* and *Agabus labiatus* present on the Yorkshire heaths. *Acilius* is an uncommon, northern beetle which seems to favour the small pools which form in the hollows created by uprooted trees or old peat-cuttings.

The wetter heaths usually have a fair amount of willow carr as well as the inevitable encroachment of birch scrub. Although scrub is a threat to heather-dominated communities on neglected sites, its occurrence on managed heaths is of positive benefit to invertebrates. Besides providing shelter for winged insects on stormy days, willow and birch scrub is also capable of supporting an interesting invertebrate fauna in its own right. Providing the advancing front of such scrub is controlled, a vast array of phytophagous beetles and moths will breed in such conditions, including many scarce species which clearly favour these bushes growing in a heathland environment. Of particular importance in the Region is the

scarce vapourer *Orgyia recens*, a moth which has declined throughout its British range and is now confined to Yorkshire, Lincolnshire and Norfolk. It is known to feed on several different plants but heathland willows are apparently preferred. The dark-bordered beauty *Epione parallelaria* is another national rarity found on the Vale of York heaths which has willow and birch as its foodplants. The foliage of these heathland shrubs is eaten by a great variety of insects, including the noteworthy weevils *Magdalis carbonaria*, *Dorytomus salicinus* and *Rhynchites longiceps*, all of which have been recorded from the Yorkshire heaths. Larvae of the lunar hornet *Sesia bembeciformis* and large red-belted *Synanthedon culiciformis* clearwings bore into the trunks of mature willow and birch respectively and older, decaying willows are host to the attractive and uncommon longhorn beetle *Strangalia quadrifasciata*. Willow carr is also home to many invertebrates that live and breed amongst the wet, shaded conditions of the ground-layer, rove-beetles, spiders and flies, for instance, and where carr is well-established it should be retained but not allowed to encroach detrimentally onto the open heath.

Sandy, dry heath is less frequent in the Vale of York and relatively few notable invertebrates are recorded from this habitat. This is partly because the thermophilous species which typify dry heaths are more likely to occur on the hotter, southern heaths and ground temperatures are not high enough for them in Yorkshire. However, dry heath is still an important component of these northern heathlands as it provides warm, open ground for basking and hunting as well as supporting its own distinctive fauna. Management, either through grazing, burning or vehicular disturbance, which creates pockets of bare sand, is vital to maintain the patchwork mosaic of open ground and more mature heath. It should be recognised that heathland owes its very existence to these activities and that its wildlife is quite capable of coping with such seemingly catastrophic events provided they are carried out on rotation in parts of the site only.

Predators, in particular, abound on sandy heaths and one of the most characteristic species is the green tiger beetle *Cicindela campestris*. The larvae of this carabid live in burrows dug into the sand where they prey upon small invertebrates which fall into the entrance pit. They, in turn, are attacked by the parasitic wasp *Methoca ichneumonoides*, a scarce species which is known from the ride systems on Allerthorpe Common. The female enters the *Cicindela* burrow and paralyses the resident larva before depositing a single egg and then closing the burrow behind her. *Methoca* has disappeared from many of its former localities in Britain because of the loss and neglect of sandy habitats. Other uncommon ground-beetles of the open heaths include *Pterostichus lepidus* and *P. angustatus* whilst *Dyschirius politus* requires bare damp sand in which to burrow. Uncommon spiders, Scotina *gracilipes* and *Steatoda phalerata* for example, have also been recorded from the areas of dry heath

but there are many invertebrate Orders which have received little attention so far. The Diptera would be a profitable group to survey with little of known interest other than the robberfly *Epitriptus cingulatus* and the wet heath habitats in particular can be expected to be of considerable significance for this group.

The windblown sands of South Humberside were deposited over the Lincolnshire Limestone escarpment about 10,000 years ago and in places lie up to ten metres deep. Coversand heaths were once established over an extensive area of these sands but reclamation for agriculture and the planting of conifers has left just a handful of remnant heaths of conservation value. In addition, the numerous disused sand-workings and brick pits in the area often support fragments of heath on their fringes. These are practically unknown entomologically but are likely to provide refuges for some of the more characteristic heathland invertebrates and these sites should be regarded as a valuable contribution to the habitat resource.

Four heathland sites of high quality have survived in South Humberside, ranging from the wet acidic heath of Wrawby Moor to the somewhat calcareous grass-heath of Risby Warren. Large heath butterflies *Coenonympha tullia* were formerly known from the wetter areas of Manton Common but otherwise the wet heath fauna has received relatively little attention. Similarities can be expected with the wet heaths of the Vale of York, although the fragmentary nature of these southern sites suggests that the fauna may not be as rich as the

extensive blocks of uniform habitat occurring on Skipwith and Strensall Commons. More interest has been shown in the invertebrates of dry heath and bare sand in South Humberside and this has highlighted the considerable importance of such areas. Risby Warren, consisting of 150 hectares of grass-heath and inland sand dunes, is outstanding in this regard. Attempts were made in the 1920's to stabilise the sand by the introduction of marram grass *Ammophila arenaria*. This has succeeded to some extent but mobile sand is still a feature of the site and large areas are covered by sparsely-vegetated sandy ground which is highly reminiscent of the Breckland heaths of East Anglia. A strong population of rabbits maintains short-turf conditions on grassy areas and their scrapes and burrows sustain a diverse flora of ruderals which provide important nectar-sources for the heathland invertebrates. This botanical richness is also a product of the underlying limestone which promotes a calcareous flora where the sands are shallow, contrasting with pockets of dry acidic heath on deeper sands.

In contrast to the distinctly northern flavour of the Vale of York heaths, these hot sandy areas south of the Humber are essentially southern in character and support several scarce species which are more typical of heaths much further south. For instance, the click-beetle *Cardiophorus asellus* occurs here at its northernmost locality in Britain, whilst the fly *Dolichopus migrans* and the ground-bug *Ortholomus punctipennis* (both recorded from Risby) are characteristically regarded as Breckland specialities. There is also a group of species present which are more usually found on coastal dunes and which rarely occur inland, including species from a variety of invertebrate Orders such as the wolf-spider *Arctosa perita*, the ground-beetle *Broscus cephalotes*, the dune chafer *Anomala dubia*, the bug *Trapezonotus arenarius* and the fly *Helina protuberans*. Other sandy ground invertebrates of note recorded from Risby Warren are *Thereva plebeia* (a stiletto fly), the dung beetle *Aphodius distinctus* and the ground beetles *Cymindis axillaris* and *Calathus ambiguus*.

Further recording on Risby Warren and other sandy heath sites on South Humberside, like Messingham Sand Quarry, will undoubtedly confirm their importance nationally for the conservation of heathland invertebrates. The continuing loss and degradation of dry heathland in southern England through development pressures and management neglect gives added significance to the conservation of the Coversand heaths and management plans should clearly take account of the need to maintain the invertebrate-rich communities of the pioneer stages of heath. The Vale of York heaths complement their southern counterparts by offering more substantial areas of wet heath with a different, but equally important, invertebrate fauna. Management problems are perhaps more acute here with scrub and bracken invasion lowering water-tables and reducing the extent of open heath.

Practical steps, such as the re-introduction of sheep grazing to Skipwith Common, will be necessary to ensure that they continue to provide the habitat-diversity required by their resident fauna. Quality heathlands only account for a minute proportion of the semi-natural habitat extant in North-east England but their value to invertebrate conservation nationally justifies their high priority for management and research resources.

OPEN WATER and its margins

This Review is concerned primarily with terrestrial invertebrates but there are so many species which spend the early stages of their life in aquatic or semi-aquatic habitats that a chapter dealing with Open Water sites is essential. Dragonflies are obvious examples, developing as nymphs under water for one or two years before crawling to a nearby bank or plant stem and emerging into the air to complete the transformation into the glorious adult insect. Mayflies, caddisflies and stoneflies have a similar life-history, as do the members of several families of the true flies (Diptera). A briefer, but nonetheless essential, acquaintance with land is sought by the larvae of water beetles, leaving the water only to find a safe place for pupation and then, once the transformation is over, they return to the pond or river to begin their adult life. No matter how brief the encounter, those invertebrates which are obliged to spend at least part of their lives in both aquatic and terrestrial habitats are dependent upon suitable conditions occurring in both environments to enable them to complete their life-cycle. Such species play a dual role as indicators of habitat quality, highlighting those sites which contain water-bodies and marginal habitats of conservation value.

The condition of our lowland rivers typifies this position. Eutrophication or pollution can seriously deplete the aquatic fauna with little noticeable effect on the physical structure of the river. Channel-straightening, on the other hand, is readily observable as causing damage

to bankside habitats but it also deprives aquatic invertebrates of the complex mosaic of micro-habitats - the root systems, shoals, emergent vegetation, etc. - that is necessary for their development. Rivers, therefore, which are known to support a rich diversity of aquatic invertebrates are also very likely to be significant for their marginal faunas, and vice-versa. In their upper reaches, few riverbanks are affected by flood defence works and threats arise from acidification due to the planting of conifers or by nutrient enrichment from fertiliser run-off on agriculturally-improved catchments. Problems are compounded in the lowlands where canalisation, industrial pollution, sewage disposal and domestic tipping are among the many influences which lead to a deterioration in the conservation value of our major rivers.

This is certainly the case in North-east England, a Region which is blessed with many beautiful rivers although very few of them maintain their importance for nature conservation from source to mouth. Of the major rivers, the most intact example is undoubtedly the Yorkshire Derwent. Flowing for approximately 100 kilometres, this major tributary of the Ouse rises on the acidic moorland of the North York Moors and becomes more calcareous as it passes along the junction between the limestone of the Howardian Hills and the chalk of the Yorkshire Wolds. Its lower reaches meander through the largely unspoilt floodplain of the Derwent Ings. Although parts of the river have been canalised in the Vale of Pickering, there has been little disturbance along most of its length and the excellent range of aquatic and marginal plants which thrive in its clean waters is also reflected in the richness of its invertebrate fauna. Species indicative of the combination of good water-quality and lack of bankside disturbance include the stoneflies *Taeniopteryx nebulosa*, *Diura bicaudata* and *Rhabdiopteryx acuminata*, and the mayflies *Heptagenia fuscogrisea*, *Brachycerus harrisella*, *Ameletus inopinatus* and *Caenis robusta*. The muddy banks of the river at Derwent Ings are inhabited by a distinctive community of beetles and the sluggish waters have a typical mollusc fauna for clean rivers, including *Pseudanodonta complanata*, *Pisidium hibernicum*, *Theodoxus fluviatilis* and *Unio timidus*.

Other significant rivers in North Yorkshire are the Rye, Swale, Ure and Wharfe although, in general, it is only relatively short stretches that have received attention from invertebrate zoologists. Whereas the freshwater crayfish *Austropotamobius pallipes* (a good indicator species of water-quality) is known from several of the North Yorkshire river systems, there is little available information on the aquatic fauna for most of them. More effort has been concentrated on bankside faunas and sites such as the River Rye in Duncombe Park or the banks of the Wharfe at Otley and East Keswick have considerable invertebrate interest. Much of the Wharfe is unmodified and suffers little from pollution and eutrophication and has many riverbank features which are of prime importance for invertebrate conservation.

At Otley, where the river cuts through the sand and clay deposits along the valley, burrows of the rare rove-beetle *Bledius defensus* can be found in the low riverside cliffs. This species is more or less confined to a handful of riparian sites in Yorkshire. Crevices in the cliff-banks shelter populations of the ground beetle *Bembidion fluviatile* whilst sandbanks along the river's edge support the uncommon scarabaeid beetle *Aegialia sabuleti*, a characteristic species of sandy river banks. Predatory empid flies are well-represented on this site with records of the national rarities *Leptopeza borealis*, *Platypalpus subtilis* and *Tachydromia woodi* as well as several commoner riverbank species. Undisturbed bankside deposits of sand and fine gravel are required for these empid flies as they run rapidly across the open ground in search of prey.

The best gravel banks at Otley used to be situated on the north side of the river but natural processes of erosion and sediment transport mean that they are now becoming established on the southern (W. Yorks) bank. This necessitates the conservation of longer stretches of river than may at first seem required as it is important to anticipate future changes in bank structure in response to river mobility. This is also the case at East Keswick Fitts, where most of the invertebrate recording has been done in West Yorkshire but riverbend meanders on the north side are likely to be of similar importance. East Keswick has extensive deposits of sand on both banks well away from the water's edge, some of which now supports well-developed willow carr. Scarce riparian invertebrates such as *Platypalpus subtilis*, the stiletto fly *Thereva lunulata* and the dolichopodid fly *Rhaphium rivale* are recorded and there is potential for many interesting discoveries to be made here, although management may be required to ensure that invasive stands of Himalayan balsam *Impatiens noli-tangere* do not smother all of the open sand areas.

Paradoxically, two of the most notable aquatic sites in Humberside are the disused sections of the Pocklington and Leven Canals. When they were open to boat traffic they would have been of relatively little interest but they have both been closed long enough to have gained valuable floras and faunas in their own right. Whilst they lack some of the bank variability that adds diversity to the natural water-courses they do approximate to the sluggish stretches of lowland rivers to some extent. The present lack of disturbance means that stands of emergent vegetation are widespread and the aquatic flora has also developed accordingly. Their value is enriched by their situation as the Leven Canal was cut through the site of one of the former Holderness meres and the Pocklington Canal empties into the clean waters of the River Derwent. This has enabled the ready colonisation of the canals by invertebrates from nearby localities. Both canals support strong populations of the red-eyed damselfly *Erythromma najas* at its northernmost limit in Britain and, in addition, Pocklington also has a colony of the rather scarce variable damselfly *Coenagrion pulchellum*. Amongst a range of notable invertebrates recorded from the canals particular mention must be made of the reed beetles. These chrysomelids develop on aquatic plants and many species pupate underwater by piercing the submerged stems and obtaining oxygen via the plant cells. At least nine different species are known from the two sites, including such rarities as *Macroplea appendiculata*, *Donacia impressa*, *D. thalassina* and *D. sparganii*. This is quite a remarkable assemblage and is indicative of both the quality of the flora and the lack of disturbance as these species are particularly vulnerable to dredging operations.

Further north, the stony Northumberland rivers draining the Cheviot Hills and the northern Pennines contain many excellent sites in their upper and middle reaches. Unpolluted gravel bed rivers support good populations of riffle-beetles which are intolerant of poor water-

quality and riverbed disturbance. The River Irthing, for instance, has a group of nationally scarce water beetles such as *Deronectes latus*, *Hydraena pulchella*, *H. rufipes*, *Riolus cupreus* and *R. subviolaceus*. This area also holds important colonies of freshwater crayfish on the Wansbeck, Blyth, Coquet and Allen rivers. This population is geographically isolated from other catchments supporting this native species and as such may prove to be a valuable refuge against crayfish plague which threatens the species over much of England and Wales.

Another important aspect of the Northumberland rivers is their bankside deposits of sand and shingle. Much work remains to be done on the survey of river shingle invertebrate faunas in North-east England but it is already clear that there are at least three sites of national significance. Staward Woods at the confluence of the East and West Allen is an outstanding example with extensive 'terraced' gravel banks backing onto willow scrub. This site contains a mixture of fine gravel deposits and coarser pebbles providing a range of shingle types and the 'terracing' presents areas of shingle subjected to differing degrees of flooding and mobility. Whereas shingle banks along the straighter stretches of river are often temporary, certain situations, like the inside bend of meanders or the confluence of tributaries with the main river, develop more or less permanent banks in response to channel-flow. The importance of the Allen confluence is heightened by the long history of shingle deposits at the site and the richness of its fauna reflects this. It is of particular significance for its spider fauna, with the national rarities *Centromerus persimilis* and *Diplocephalus connatus* occurring with other uncommon species restricted to this type of habitat, including *Caviphantes saxetorum* and *Arctosa cinerea*. Riparian beetles are also of note here with a comprehensive range of species associated with shingle banks in Northumberland, many of them with a very localised distribution nationally. A characteristic species of sparsely vegetated damp sand and gravels in Northumberland is the ground beetle *Bembidion schueppeli*. It is fairly widespread along the banks of lowland rivers and streams in the area but is more or less restricted to the Border counties of England and Scotland.

Beltingham Gravels on the River South Tyne is another quality site and this is one of the few shingle banks in Northumbria that has been reasonable well-surveyed for Diptera. Three species of cranefly recorded here (*Nephratoma dorsalis*, *Nephrotoma analis* and *N. submaculosa*) are uncommon inhabitants of sandy riverbanks, although the latter species also occurs on sand dunes. The largest area of sandy riverbank in the Region is on the River Till downstream of Doddington Bridge. Here the river cuts through the former sandy bed of a glacial lake and bank erosion from river spates deposits shallow banks along much of its length. Falling summer water levels leave broad sandy margins with temporary pools that are occupied by a host of rare species. Only the beetles have been thoroughly sampled to

date but they include the ground beetles *Bembidion litorale*, *B. schueppeli* and *Amara fulva*, the rove beetles *Tachyusa scitula*, *Philonthus rubripennis* and *Thinobius strandi* and the water beetles *Georissus crenulatus* and *Ochthebius bicolon*. The extent of suitable habitat on the Till and the quality of its known fauna make this an extremely important site for the conservation of riparian invertebrates and investigation of other groups should confirm this. Unfortunately, the grasslands are agriculturally improved up to the top of the riverbank on either side and considerable benefit could be gained by fencing off sections of the field margin to revert to semi-natural vegetation.

Standing water-bodies of conservation interest in the Region are less well-known than the rivers and canals and much useful information could be provided by invertebrate surveys. Several upland areas contain a number of natural tarns and loughs which are of potential value but the lack of information makes it difficult to assess their importance. The Northumberland Moors, for instance, have a scatter of small tarns which are subject to fluctuating water-levels. This results in a seasonal band of bare silt around the water's edge, a feature which is likely to support a diverse assemblage of invertebrates with a restricted distribution nationally. The mud snail *Lymnaea glabra*, a rare and declining species which inhabits temporary water margins, is known from a few of these tarns and other scarce and interesting invertebrates are also likely to occur in these conditions. Some of the larger Northumberland loughs have been partially surveyed and characteristic upland insects, like the water boatman *Corixa dentipes* and the water beetle *Agabus arcticus*, are recorded. At Harbottle Lough on the Cheviot Hills a specimen of the rare scatophagid fly *Ernoneura argus* has been found. This is normally associated with lochs in the Highlands of Scotland where it usually occurs on exposed shores. Other natural loughs (Crag, Broomlee and Greenlee are the largest) are relatively unknown and detailed investigation of the aquatic and marginal fauna would be of great interest.

There are few upland ponds of any significance in Co. Durham but Tarn Dub, a shallow pond dammed by a glacial moraine on Cronkley Fell, is a valuable site. This, too, has a fluctuating water-level and in the summer months the water recedes to leave small pools choked with sweet-grass *Glyceria* sp. The mud snail is also known from this tarn and the uncommon ramshorn snail *Gyraulus laevis* has been recorded. In Yorkshire, hardly any information exists for the numerous small tarns of the Dales in the west of the county. However, this area also has one of the best-known upland water-bodies in Britain - the nationally important marl lake of Malham Tarn. The Tarn overlies Carboniferous Limestone and Silurian shales and has a maximum depth of 4.4 metres. Its waters are high in calcium, allowing the stonewort *Chara globularis* to dominate the submerged flora along with shining pondweed *Potamogeton lucens*. At 380 metres a.s.l. it is the highest marl lake in

Britain and its fauna includes species of arctic-alpine distribution such as the crustaceans *Bryocamptus rhaeticus* and *Moraria miazeki*. Of particular importance entomologically is the presence of a strong population of the flightless caddisfly *Agrypnia crassicornis*. This is the only site known for this species in Britain and it is apparently extremely rare throughout western Europe. Although the adults occur around the margins of upland calcareous lakes the larvae are found in deep water in the centre of the Tarn. The adults crawl down stones on the exposed lake shore to lay their egg-masses under water. The newly-hatched larvae are then washed off the stones by wave action and carried out to the middle of the lake by underwater currents. There they settle in beds of *Chara* and *Potamogeton* and use fragments of these plants to construct a protective case. Another rare caddis, *Rhyacophila septentrionis*, occurs in the inflow stream of the Tarn and here, too, larvae of the cranefly *Triogma trisulcata* (which is known only from a handful of sites in upland regions) cling onto mosses growing in the water. Many more rarities, like the chrysomelid beetle *Macroplea appendiculata* which breeds on *Potamogeton*, are known from Malham Tarn and this is clearly one of the most outstanding invertebrate sites in the Region.

In the lowlands of North-east England there appear to be very few natural bodies of standing water and only Hornsea Mere on Humberside is currently recognised as being of national significance for invertebrate conservation. Hornsea is the last remaining example of the Holderness meres, a series of glacial depressions in the boulder clay which mantles the district. These meres must have been of great importance for wildlife in the past but they were systematically drained and only Hornsea has survived to give a hint of the former riches of the area. The mere is a shallow eutrophic lake of about 120 hectares in area and has fringing reed swamps and carr woodland of great entomological interest. Fenland invertebrates are well-represented and include characteristically southern species such as the spiders *Donocochara speciosa* and *Entelecara omissa* and the beetles *Psammoecus bipunctatus* and *Silis ruficollis*. The rare muscid fly *Phaonia atriceps*, whose larvae live as predators within the leaf-sheaths of reedmace *Typha* spp. and other tall fen plants, is one of many other scarce wetland species that have been recorded from the lake margins.

Many of the Region's wildlife sites contain natural ponds that provide additional habitat diversity for their invertebrate fauna but the majority of lowland water-bodies that are of known conservation significance have been artificially created by the extractive industries. Disused quarries, sand workings, clay-pits, and subsidence due to shallow coal-mining have given rise to a vast number of potentially important open-water habitats. The value of these sites to invertebrate conservation is dependent upon a range of environmental factors but it is clear that the richest localities in the long-term are those which are situated in areas with a history of wetland conditions. Shibdon Pond on the outskirts of Newcastle is a good

example as this large subsidence pond has been formed in the floodplain of the Tyne and its invertebrate richness is chiefly due to the proximity of wetland habitats in the valley, most of which have long since disappeared. Extensive marginal fens of reedmace and reed sweet-grass *Glyceria maxima* support an important assemblage of wetland invertebrates, particularly Diptera. Nationally uncommon species include several snail-killing flies, the hoverflies *Platycheirus perpallidus* and *Anasimyia contracta* and the muscids *Phaonia atriceps* and *Lipse pygmaea*. Other groups, such as the Hemiptera and Coleoptera, have been surveyed and, whilst no rarities have been discovered so far, a large number of species typical of lush fens have been recorded. Another quality open-water site that has been artificially created is the series of flooded clay pits on the south bank of the Humber at Barton and Barrow. Most of these pits have some saline influence and contain large areas of reedbed. They support several brackish water invertebrates which are scarce nationally, the beetles *Macroplea mutica*, *Gyrinus caspius* and *Haliplus apicalis* for instance, and a typical reedbed moth fauna occurs here as elsewhere on the Humber marshes.

These artificial sites, with their fringing wetlands, now provide important refuges for many invertebrates which have declined in North-east England as traditional wetland habitats have been lost to agriculture and industry. The recognition and conservation of sites which contain faunas representative of the semi-natural habitats they mimic is an integral part of the conservation strategy of open-water habitats in the Region but it is of even greater importance to safeguard against the deterioration of the existing natural water-bodies. The entomological value of recently-created ponds and wetlands is a result of the more widespread occurrence of natural and semi-natural habitats in the past, facilitating colonisation of the new sites. The growing isolation of lowland wetland habitats will mean that only highly mobile, and hence less threatened, invertebrates will be able to benefit in this way in the future.

LOWLAND PEATLANDS

The key to the conservation of the invertebrate richness of lowland peatlands in Britain lies in the maintenance of naturally-occurring water-levels. The hydrological regime is of critical importance as it is only the presence of a high water-table for most of the year that holds ecological succession in check and sustains the characteristic vegetational communities of the peatland habitats. As peatlands, by definition, are habitually waterlogged, it follows that the members of the peatland invertebrate fauna are essentially hygrophilous and hence their fortunes are closely-linked to the quality and reliability of the water-input. Activities which interfere with either the source of that water or its flow through the peatland system will have a major impact on the nature of the peatland vegetation, the habitat-structure, and the composition of its invertebrate fauna. Unmodified peatlands are now extremely rare in lowland Britain and the remaining examples are highly-prized for their scientific importance in many academic disciplines. They are also of outstanding significance for nature conservation and many of our rarest invertebrates are restricted to the threatened habitats of Britain's dwindling peatlands.

The largest area of lowland peat in North-east England once covered a huge area of the Humberhead levels. Although much of this expanse of contiguous fens and mires was in South Yorkshire, a high proportion was situated in south Humberside around the Isle of Axholme and as part of the Thorne Moors complex. Today there are only a few surviving fragments as peat-cutting, drainage and agricultural reclamation have taken their toll. However, these remnants still represent a substantial amount of the lowland peatland of the Region and, whereas they have been considerably modified by peat-cutting over the centuries, they retain elements of the fauna which was once widespread. This is particularly true of the two remaining pockets of the Isle of Axholme fens - Epworth Turbary and Haxey Grange Fen. It is ironic that the Isle of Axholme was once completely surrounded by fen peat, but now it is the two peatland sites which are islands, isolated in a sea of productive farmland.

Up until twenty years ago, Epworth Turbary supported a colony of large heaths *Coenonympha tullia* at the southern limit of their range in eastern Britain. Their extinction at this site is symptomatic of the problems associated with these fragmented sites as large heaths require a fairly large area of saturated bog to sustain a viable population. As peripheral drainage lowered the water-table and birch and bracken invaded the drying peat, large heaths became an inevitable casualty and many more less-conspicuous invertebrates must have also vanished as conditions deteriorated. Epworth is a nature reserve and conservation management aims to restore some of the wetter peat habitats to the site. This

will undoubtedly be beneficial but the absence of nearby refugia will limit the fauna which is able to take up the opportunity of re-colonisation. Highly mobile species are the most likely beneficiaries, such as the fine assemblage of breeding dragonflies that is already established, but many members of the peatland invertebrate community are unlikely to return.

Black darters *Sympetrum danae* and four-spotted chasers *Libellula quadrimaculata* are amongst the characteristic peatland dragonflies which occur on Epworth Turbary but recording has revealed few peatland specialists in other groups. The main invertebrate interest of the site is concentrated on the water-beetle fauna (including the nationally rare *Hydroporus rufifrons*) of a series of seasonally-flooded grassy pools. This is also true of Haxey Grange Fen a few kilometres to the south, its peatland fauna diminished by isolation and habitat-change. Although this site has received scant attention from entomologists so far, it is apparent that the chief interest is associated with bands of bare peat exposed on pool margins by fluctuations in the water-table during the summer months. This provides ideal habitat for the predatory ground-beetles *Acupalpus dorsalis*, *Bembidion gilvipes*, *B. obliquum* and *Blethisa multipunctata*. Lowering of the water-table by the twin effects of drainage of the adjacent land and evapo-transporation from scrub invasion will accelerate succession on Haxey Fen unless this problem is addressed and these last vestiges of the peatland fauna will consequently disappear.

Fortunately, two large areas of the Humberside Levels peatlands have survived and both are unquestionably of national significance for the conservation of peatland invertebrates. Hatfield Moors and the majority of the Thorne Moors complex are situated in South Yorkshire and covered by the Nature Conservancy Council's North-west England Region, but Crowle Waste, on the north-eastern edge of Thorne, is in south Humberside. Other parts of the Humberside section of Thorne Moors have been severely damaged by peat-cutting and Goole Moors has been completely destroyed by the extraction of horticultural peat. The Crowle section is hydrologically detached from the main body of the Thorne mire and has not suffered as badly from drainage as other areas. The best parts contain acid mire communities associated with old peat-cuts which were dug in strips leaving raised baulks between them. These baulks support mature heather and birch scrub whilst the cuts are dominated by bog-mosses and cotton-grass *Eriophorum angustifolium* with localised stands of common reed *Phragmites australis*. Crowle Waste has not been studied as extensively as the rest of Thorne Moors but has, nonetheless, produced records of an excellent range of scarce peatland invertebrates. One of the specialities of the site is the ground beetle *Bembidion humerale*, a rare species throughout Europe which is entirely confined to acid bogs. In Britain it is known only from the Humberhead Levels mires, where it occurs

amongst algal mats growing on the bare margins of pools and old peat-cuttings. The Lepidoptera are also represented on Crowle Waste by a number of characteristic mire species, such as the purple-bordered gold *Idaea muricata* and Haworth's minor *Celaena haworthii*, whilst the strong population of large heaths is here at the southernmost extent of the species in eastern Britain.

North of the Humber peatlands have suffered like other lowland habitats and good examples are very localised throughout the Region. They are particularly rare in North Yorkshire but the county still has two exceptional sites in Austwick and Lawkland Mosses and Askham Bog. There is a long tradition of recording at both sites and extensive lists of rarities were compiled in the first half of this century, notably for Diptera at Austwick and Coleoptera at Askham. Austwick and Lawkland Mosses are a pair of large, connected basin fens in the valley of the River Wenning in the Yorkshire Dales. These were formerly raised mires but traditional peat-cutting has reduced the depth of peat to a maximum of two metres and the mire surface is now a mixture of poor-fen and ombrotrophic mire communities with a mosaic of pools and wet hollows in the centre. Reedswamp forms a narrow fringe around the edge of the basins, influenced by run-off from the surrounding calcareous soils, and the bog habitats are further diversified by the presence of willow and birch carr. Drainage of adjacent farmland has resulted in a lowering of the water-table across the mire system and encroachment by birch and pine scrub. This has undoubtedly affected the peatland habitats and some loss of invertebrate interest will have occurred. It is still likely, however, that many of the rarities known from this site, including the Red Data Book craneflies *Limnophila fasciata*, *Limonia aperta* and *Prionocera pubescens*, have managed to survive at reduced population levels and modern surveys are required to determine the current value of Austwick and Lawkland Mosses for invertebrate conservation. Previous recording has shown that they have an excellent northern peatland fauna which will become increasingly threatened as the mires continue to dry out. Further deterioration of such a quality site would be a great loss to wildlife conservation and positive management is urgently required to raise water levels and stop scrub invasion.

Askham Bog, on the outskirts of the City of York, is a remnant valley fen which is enclosed by glacial moraines containing significant amounts of limestone debris. The resulting base-enriched ground-water produces neutral conditions across the fen with stands of great fen-sedge *Cladium mariscus* indicating the minerotrophic nature of the system. Affinities between Askham and the East Anglian fens have often been noted, although Askham now represents a later stage in the succession to fen woodland than most of the classic Norfolk sites and open mire communities are very restricted. In fact, much of the site is covered by oak, birch, willow and alder woodland with much of its invertebrate interest lying in the

established fauna of the swampy carrs. Management is aimed at keeping scrub from invading the few remaining areas of open fen which support a distinctive and important assemblage of peatland invertebrates. Formerly, a series of flooded brick-pits at Chandler's Whin on the edge of the Bog supported an outstanding assemblage of water-beetles but they were infilled many years ago and only four of the thirty rare species previously recorded have been found in recent years. Askham Bog is a classic locality for the rare ground-beetle *Trechus rivularis* which is frequent here in shaded wet woodland. Elsewhere it occurs in carr and dense litter in a few fens in eastern England and on heather-dominated blanket mires in northern England and Wales. Other species which link Askham Bog with the East Anglian fens include the beetles *Dromius sigma*, *Bibloplectus tenebrosus*, *Agabus undulatus*, *Oxytelus fulvipes* and *Hypera diversipunctata* and the mirid bug *Capsus wagneri*.

Northumbria has a broader scatter of lowland peatlands but, nevertheless, they are still a scarce resource and all surviving sites are worthy of survey and conservation. Some of these, such as Butterby Marsh (an ox-bow meander on the River Wear) or Hetton Bog (a valley fen supplied with ground-water by springs emerging from Magnesian Limestone) are of considerable potential and could produce some notable discoveries. Others, like Bearpark Bog, the only lowland raised mire left in County Durham, have been reasonably well-surveyed and whilst they have not been shown to support any particular rarities they do contain invertebrate communities which, although typically impoverished, are characteristic of the habitat-type. Such sites are deserving of conservation as examples of a threatened and distinctive species-assemblage.

Two peatland sites in the lowlands of Northumbria, both of which are basin fens, stand out as being of prime importance. Hart Bog in Cleveland is situated in a steep-sided hollow, known as a kettle-hole, formed by the melting of a block of ice trapped in glacial deposits overlying Dolomitic limestone. The centre of the mire consists of a carpet of bog-mosses with dwarf shrubs and this is surrounded by a 'lagg' community of poor-fen vegetation characterised by an abundance of marsh cinquefoil *Potentilla palustris*, bottle sedge *Carex rostrata* and common cotton-grass. Willow carr forms a narrow fringe on all sides and pockets of herb-rich fen, notably containing a population of greater spearwort *Ranunculus lingua*, are also present. This small site is of outstanding interest for its water-beetle fauna and contains six nationally scarce species amongst the thirty-three species recorded. Of particular significance is the occurrence of *Hydroporus scalesianus*, a fenland relict which is intolerant of drainage and other disturbances to the hydrological regime. It is known elsewhere from a single site in Cumbria and a handful of localities in the Norfolk fens and is considered to be confined to fens which have been undisturbed since the last glaciation. The vegetation and structure of Hart Bog clearly demonstrate that the mire has developed

without modification to the water-table or peat-surface. However, the site is now completely surrounded by arable fields and there is always a possibility that nutrient run-off could reach the mire and affect its trophic status.

The other outstanding lowland peatland in Northumbria is the National Nature Reserve of Newham Fen. This is a eutrophic basin mire which represents the last remnant of a much more extensive area of wetland, known as Embleton's Bog, which was drained in the mid-nineteenth century. Newham Fen now occupies a hollow lying next to a glacial esker, from which it is believed to be fed by base-rich springs emerging from the calcareous till. Hydroseral succession is well-developed and most of the fen is covered by mature birch and willow carr, beneath which there is reedswamp and stands of tall sedges and reed canary-grass *Phalaris arundinacea*. One small clearing is maintained within this carr and this supports an excellent flora whilst providing sunny, sheltered conditions for many of the fen invertebrates. Active management is essential to keep this glade open but it also presents a dilemma in that the leading edge of the scrub, as in so many habitats, is favoured by a number of phytophagous species. One of the specialities of Newham Fen is the dark-bordered beauty *Epione parallelaria*, a nationally rare moth which feeds on birch and willow scrub as a larva. The number of adults seen each year on the fen suggests that there is a healthy population present but the larvae have yet to be found and, until their breeding site is identified, a cautious approach is necessary in scrub control. Other notable moths of the wetland scrub recorded from Newham include the olive *Ipimorpha subtusa*, ruddy highflyer *Hydriomena ruberata*, small chocolate-tip *Clostera pigra* and pinion-streaked snout *Schrankia costaestrigalis*. Much scope exists for recording in a wide range of invertebrate groups and casual surveys have already produced records of scarce Diptera, such as the handsome soldier-fly *Stratiomys potamida* and the snail-killing fly *Dichetophora finlandica*.

Modern advances in drainage technology place lowland peatlands throughout Britain in the category of being amongst the most vulnerable of our semi-natural habitats. Quality sites, where peat has perhaps accumulated over the past 6-8000 years without disturbance, are now extremely rare and it is impossible for Man ever to recreate the historical communities of plants and animals occurring on peatlands. Fens which have developed more recently or which are derived from past peat-cutting activities, for instance, are equally scarce and support valuable elements of the peatland fauna which was once so widespread in Britain, as shown by sub-fossil remains identified from peat deposits. Lowland peatlands should be seen for what they are, a limited and finite resource which is readily diminished by events which affect the mire surface, the adjacent water-table, or even the surrounding catchment. The invertebrate fauna of lowland peatlands is, therefore, continually under threat and its conservation is deserving of our utmost efforts.

UPLANDS

The assessment of upland habitats in terms of their importance for invertebrate conservation is often hampered by the patchy nature of the available information and this is particularly true in Regions, such as North-east England, which have an extensive and varied upland landscape. Enough difficulties face the field zoologist carrying out surveys in the lowlands but these are often compounded by problems of inaccessibility, climate, and low population densities when dealing with upland invertebrates. Sites which are within relatively easy reach of motorable roads have become traditional 'honeypots' for recording and for some of these lengthy species lists have been compiled over the years. Although it can be difficult to put such sites into context, knowledge of species' ecology and their recorded micro-sites does enable the invertebrate conservationist to make predictions about the potential of poorly-worked habitats when features such as vegetation structure, underlying geology and land management are known.

The information compiled for the Invertebrate Site Registers in North-east England demonstrates this predicament as there are a number of sites which, as a result of recorder-bias, appear to support richer faunas than similar localities in the same area. This is not surprising as North-east England has such a wealth of high-altitude habitats that it will require a vast expansion of survey effort before an informed evaluation of site-quality is considered. What is possible at this stage is the identification of those sites which, because

of their environmental characteristics and known faunas, are unquestionably of national significance.

The western half of the Region is almost entirely upland in character, comprising the eastern peaks of the Pennine ridge, and to the north this links up with the Northumberland Fells. The most valuable areas for upland nature conservation here are the Yorkshire Dales, Upper Teesdale and the Cheviot Hills. Isolated from this high ground is the plateau of the North York Moors at an altitude of c. 400 metres a.s.l. and covering an area of some 100 sq. kms. These four blocks each contain many remote and poorly-known sites but there has been good coverage of some of the more accessible areas in recent years and it is possible to highlight a selection of the richest habitats.

The highest peak in North-east England is the summit of Cheviot at 815 metres, the slopes of which are covered with blanket mire and drier heather moor. It is a favoured locality for entomologists but there is a need to draw together undocumented information as very little has been published regarding its invertebrate fauna. The undamaged moorland habitats at high altitude are likely to support an interesting range of invertebrates and there are records of three species which are not known to occur anywhere else in England or Wales. The broad-bordered white underwing *Anarta melanopa* is a day-flying moth which breeds on berry-bearing shrubs *Vaccinium* spp. above 600 metres on the Scottish mountains. It has only recently been found on Cheviot but could be well-established here as the moors contain an abundance of bilberry *V*. *myrtillus*. The montane rove-beetle *Stenus glacialis* has not been seen in England during this century but it is reasonably widespread in the Scottish Highlands where it is a predator of small arthropods living in wet moss. Similar habitats support the upland money-spider *Erigone psychrophila*, another Scottish species, which occurs amongst *Sphagnum* growing on the edges of bog-pools on Cheviot.

Although large areas of the Northumberland Fells have been afforested, particularly in the Kielder Forest district, there is still an extensive area of high altitude moorland and blanket peat remaining. The large heath butterfly *Coenonympha tullia* is a widespread member of a distinctive Lepidopteran fauna in these habitats. Harbottle Moors, for instance, has large heath, green hairstreak *Callophrys rubi*, grey scalloped bar *Dyscia fagaria*, scarce silver Y *Syngraphe interrogationis* and clouded buff *Dicrysia sannio*. Below the granite cap of Cheviot summit, the Hills are largely covered by dry heather moor on Old Red Sandstone but variety is provided by shallow mires and valleyside habitats. Several of the valleys draining the moors have flushed slopes with remnant woodlands, good examples of which are College Valley and Holystone Valley. The best of the upland bogs is probably Muckle Moss, a broad valley mire with deep peat pools on the south of the Northumberland uplands. The

pools support populations of peatland water-beetles, such as *Ilybius aenescens* and *Enochrus affinis*, and the black darter *Sympetrum danae* and keeled skimmer *Orthetrum coerulescens* dragonflies. There are many other bogs in remote parts of the western uplands of the county that are likely to prove of interest. Some of these are known to contain important assemblages of water-beetles and surveys of other invertebrate groups would be of great value.

The soft contours of the uplands of Teesdale and Weardale in County Durham, lacking the dramatic landscape of the Pennine peaks, belie their outstanding importance for upland conservation. Rising to an altitude of 636 metres on Cronkley Fell, this mosaic of sheep-grazed heather moor, blanket bog and grassland has long been known as a refuge for rare arctic-alpine plants. Many of these are associated with the calcareous grassland and flushes of the Carboniferous Limestone, particularly where this has been metamorphosed by doleritic intrusions, on Widdybank Fell. In one of these flushes, a small population of the whorl snail *Vertigo genesii* has been found in its only British locality. This tiny snail lives amongst moss and tussocks of common yellow sedge *Carex demissa* growing on the edges of the flush and has presumably survived in this exposed environment since the last glaciation. In Europe it occurs in similar mountainous habitats in Scandinavia and Switzerland. Other scarce upland invertebrates are present on the blanket mire which has formed where clays in the glacial drift overlie the limestone bedrock and impede drainage. The ground-beetles *Agonum ericeti* and *Carabus nitens* are characteristic of these peat-bogs

and the moorland moths include the slender-striped rustic *Coenocalpe lapidata*, Manchester treble-bar *Carsia sororiata* and scarce silver Y. Recent surveys have also yielded records of scarce upland flies, such as the muscids *Coenosia means*, *C. perpusilla*, *Spilogona brunneisquama*, *Thricops aculeipes* and *T. rostratus*, and the spiders *Macrargus carpenteri* and *Rhaebothorax morulus*. The unique geology of the Teesdale area and its harsh climate have combined to create ideal conditions for rare montane plants and it can be expected that there will also be a small number of invertebrates of similar rarity. *Vertigo genesii* is the first real indication of this and field zoologists working this splendid area could be rewarded by further exciting discoveries.

Widdybank and Cronkley Fells are the best-known areas of the Durham uplands but unmodified moorland is widespread in the west of the county, as at Langdon Common for instance. The valleys and gorges running down off these moors are also of considerable interest and at High Force, the biggest waterfall in England, another important invertebrate site is the ancient juniper wood, a classic locality for northern Lepidoptera. The stunted, lichen-covered trees grow amongst rocky outcrops in sheep-grazed acidic grassland and support typical moths such as the juniper carpet *Thera juniperata* and juniper pug *Eupithecia pusillata*. The lichens are fed upon by larvae of the red-necked footman *Atolmis rubricollis* whilst the northern dart *Xestia alpicola*, which feeds on ericaceous shrubs, occurs here at one of its southernmost localities in Britain.

In contrast, the acid sandstone plateau of the North York Moors is rather poor for Lepidoptera with only a handful of relatively widespread species capable of surviving on the exposed, treeless, heather moors. Agricultural improvement and afforestation has severely reduced the extent of open moorland but large areas still remain, particularly on Danby High Moor and neighbouring moors. Characteristic invertebrates inhabiting these moorlands include the ground-beetles *Carabus nitens* and *C. glabratus* and the heather-feeding leaf-beetle *Altica britteni* is also widespread. Few areas are left to develop into the mature phases of the heather cycle as burning is widely practised to improve the grazings for the sheep flocks and for the management of grouse moors. Heather management is essential to maintain the vigour of the moorland vegetation but regular burning does limit structural variety and threatens those elements of the fauna which are adapted to the older age-classes of heather and its deeper litter-layers. However, rotational burning can be beneficial if it is sympathetically planned and there are several upland invertebrates which thrive on the newly-created patches of burnt peat and exposed sandstone. A good example is the water-beetle *Helophorus tuberculatus*, which is usually very rare in Britain but in certain localities, such as the North York Moors, it can become very abundant after moorland fires. The adults and larvae frequent upland flushes on burnt peat and presumably benefit from the release of nutrients which results from the fire. Bare peat also provides a hunting-ground for moorland predators and several invertebrates are quick to take advantage of such situations, including ground-beetles, rove-beetles and the northern shore-bug *Teloleuca pellucens*.

The sandstone of the North Yorks Moors surmounts Jurassic Limestone and the peripheral valleys cut through this to form steep gorges flanked with humid woodlands and open flushed slopes. The bog bush-cricket *Metrioptera brachyptera* occurs on boggy ground in several of these valley sites and another characteristic insect is the northern wood-ant *Formica lugubris*. The ant colonies can have a major impact on the ecology of these valley woodlands as they are aggressive predators of foliage-feeding caterpillars, for instance. However, they also benefit other species which are able to live as commensals with the ants and sites such as Castlebeck and Scar or Langdale are known to support interesting myrmecophilous faunas.

The North York Moors are dominated by dry moorland on the free-draining sandstone but there are a number of small mires which support wetland invertebrates. By far the best upland mire in this area is Fen Bog on the edge of Fylingdales Moor. This extremely picturesque site is situated in a meltwater channel and has only developed in the last 150 years following the draining of the former lake and reedswamp in 1836 when the Pickering Valley Railway was constructed. The extensive valley fen is now dominated by acidic mire

vegetation with stands of bog myrtle *Myrica gale* and shallow watercourses with a rich emergent flora. Large heaths and small pearl-bordered fritillaries *Boloria selene* are abundant and there are good colonies of peatland dragonflies. A good range of moorland bugs has been recorded, including *Saldula muelleri*, *Jassargus sursumflexus*, *Tyrphodelphax distinctus* and the scarce leaf-hopper *Sorhoanus xanthoneurus*. This is also one of the few British sites for the rare leaf-beetle *Cryptocephalus biguttatus*, which has cross-leaved heath *Erica tetralix* as its foodplant. Recording of a wide variety of invertebrate groups has taken place on Fen Bog but this quality site undoubtedly has more to offer and would repay more comprehensive surveys.

North Yorkshire's other main upland district is the Dales area of the Pennines with its limestone habitats and high peaks contrasting strongly with the eastern moors. There are several summits above 600 metres offering habitats for montane invertebrates, the highest being Whernside at 736 metres. These mountain tops have been surveyed according to their accessibility and the two best-known are Ingleborough and Pen-y-Ghent. Both of these peaks have been found to support the rare montane rove-beetle *Eudectus whitei* and other high-altitude invertebrates, such as the spider *Maro lepidus*. These summits suffer from erosion by hill-walkers which can damage the vegetation and scatter loose stones that provide shelter for mountain-top invertebrates. It is likely that more intact faunas survive on less-disturbed peaks like Whernside and Fountains Fell and wider surveys of the Dales' summits would be of great interest.

Lower down on the slopes of Ingleborough are several high quality sites which are representative of some of the most interesting habitats of the Dales. Colt Park Wood is an undamaged ashwood growing on limestone pavement with deep, humid grykes and a luxuriant flora. Stands of great bellflower *Campanula latifolia* are inhabited by the attractive picture-winged fly *Platyparella discoidea* and the characteristic molluscs of the Craven Pennine limestone, *Clausilia dubia* and *Vitrea subrimata*, are also present. Scar Close is a more open pavement which has a unique flora with islands of peat supporting acidic species amongst the more typical calcicoles. This grades into a more extensive area of blanket mire which is richly flushed where the limestone rocks lie near the surface, a habitat feature of considerable interest and a breeding site for the rare cranefly *Dactylolabis sexmaculata*.

Undamaged limestone pavement is a striking formation that appears as if it should support some highly-specialised invertebrates, and indeed it does. Perhaps the most extraordinary are the flies which breed in the detritus of tiny pools (solifluction hollows) caused by weathering of the limestone surface. Several moth-fly species inhabit this curious micro-site as well as the rare biting-midge *Dasyhelea lithotelmatica*. The spider fauna of the limestone grykes is also of interest and the money-spider *Walckanaeria clavicornis* is restricted to upland limestone areas where it makes small sheet-webs amongst the crevices.

Good examples of limestone pavement occur elsewhere at sites such as Grass Wood and Oxenber Wood but grazing pressure and the removal of stone for building and ornamental

purposes has damaged a high proportion of this nationally scarce habitat. At Malham Tarn, one of the most famous invertebrate sites in Britain, only small areas of pavement are of conservation interest. Although there are scarce species associated with the surrounding limestone outcrops, it is the wetland habitats of Malham that are of outstanding importance. The Tarn itself has already been described in the chapter on Open Water (q.v.) but adjacent to this is the raised mire of Tarn Moss and the calcareous Tarn Fen.

These peatlands have a very rich flora and their variety of habitats naturally supports a diverse and interesting fauna. It is an extremely well-studied site with an exceptional list of rare invertebrates recorded over the years yet additional species are still being discovered. Examples of some of the most interesting species are the sawflies *Nematus monticola*, *N. ponojense*, *Phyllocolpa excavata* and *Pontania tuberculata*. They form galls on the leaves of different species of willow and are each known from very few sites in Britain. The leaf-beetle *Hydrothassa hannoveriana* has been found abundantly on marsh marigold *Caltha palustris* in Tarn Fen, a typical habitat for this national rarity which is nowadays almost confined to the Yorkshire Dales. The Diptera, too, are well-represented with scarce species amongst the hoverflies (*Cheilosia pubera* and *Chrysogaster macquarti*), craneflies (*Gonomyia conoviensis* and *Phalacrocera replicata*) and meniscus-midges (*Dixella obscura*). This latter species demonstrates the importance of the juxtaposition between Tarn Moss and Tarn Fen as it occurs in its few known sites in transitional swamps between calcareous fens and acid mires. The unique assemblage of habitats at Malham Tarn and the quality of

its fauna are unquestionably of national importance and provide unparalleled opportunities for the ecological study of upland limestone invertebrates. The presence of the Field Studies Council ensures that its scientific value will not be neglected.

The uplands of North-east England account for a large proportion of the land surface of the Region and encompass great variety in terms of their geology, topography and habitat composition. It is impossible in this brief summary to give more than a flavour of some of the more significant features and localities for invertebrate conservation but it is apparent that, overall, they represent the healthiest habitat resource in the Region. This is primarily because of the greater loss of semi-natural habitats in the lowlands and it is only in the agriculturally less-productive uplands that large tracts of unmodified habitat have survived to sustain a representative fauna. Of course, habitat-loss is also occurring on the higher ground, particularly through afforestation and agricultural improvement, and conservation strategies should aim to prevent the isolation of quality sites by maintaining contiguous links with semi-natural habitat. Uplands naturally contain impoverished faunas in comparison with lowland habitats but the sheer extent of the uplands of North-east England protects individual sites from local extinctions due to habitat-isolation, preserving a fauna which more completely depicts the historical communities we value as conservationists.

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APPENDIX 2: NOTABLE SITES FOR INVERTEBRATE CONSERVATION IN NORTH-EAST ENGLAND

1 ALLERTHORPE COMMON (SE 7647) - One of the few remaining Coversand heaths of the Vale of York, supporting both wet and dry heathland of long-standing entomological interest. Most of the common has been planted with conifers but the broader rides are still important for heathland invertebrates, particularly bees and wasps. Willow, aspen and birch scrub also supports many uncommon species and should be managed sympathetically with regard to their conservation. Part of the site is leased as a nature reserve to the Yorkshire Wildlife Trust.

2 APEDALE/REDMIRE MOOR (SE 0393) - The area includes moorland with outcrops of Craven Limestone and steep wooded valleys. Pitfall-sampling has revealed the presence of many nationally uncommon species, particularly amongst the predatory ground-beetles and linyphiid spiders and the dolichopodid flies. Castle Bolton Woods contain a representative assemblage of molluscs associated with lime-rich woodlands.

3 ARCOT HALL (NZ 249755) - A subsidence pond in an area of unimproved damp pasture with associated hedgerows and patches of undisturbed deciduous woodland containing an abundance of dead wood. A series of small pools choked with emergent vegetation support an interesting water beetle fauna, including the flightless *Agabus unguicularis*.

4 ASHBERRY PASTURE (SE 5684) - A complex site comprising horse-grazed calcareous pasture in the valley bottom and unmanaged deciduous woodland on the valley slopes. Base-rich seepages and rich calcareous marshes support a nationally important dipteran fauna with the rare soldier-fly *Oxycera dives* breeding amongst the mossy rills. The woodlands support populations of the nationally rare beetles *Oedemera virescens* and *Leptura sexguttata*. Included within this composite site is Ashberry Viewpoint (SE 565855) which has a strong colony of the Duke of Burgundy fritillary *Hemaris lucina* breeding amongst the scrub-covered limestone turf. Ashberry Pasture is owned by the Yorkshire Wildlife Trust.

5 ASKHAM BOG (SE 5748) - A nationally important valley fen with a long tradition of entomological recording. Base-enriched groundwater from surrounding moraine deposits gives a calcareous influence to much of the fen but there is also a central core of acidic mire vegetation. Scrub encroachment has limited the extent of open fen but management by the Yorkshire Wildlife Trust maintains glades and open water habitats. Some of the interest of the site has been lost over the years as peripheral areas have been reclaimed, particularly

an important series of pools which contained many rare water beetles. However, a good fenland fauna remains with an affinity to the fens of the Norfolk Broads, including a strong population of the rare ground-beetle *Trechus rivularis*.

6 AUSTWICK AND LAWKLAND MOSSES (SD 7666) - The two connected basin mires with peripheral areas of carr and fen were well recorded in the first half of this century and were known to contain many national rarities, particularly amongst the Diptera. More recently there have been changes in habitat quality resulting from the drainage of surrounding land and encroachment by birch and pine. It is likely that some species may have become extinct here as a result of habitat loss and surveys are required to ascertain the current importance of the site.

7 BARTON AND BARROW CLAY PITS (TA 0123) - A series of flooded clay pits of varying salinity on the south bank of the Humber. Despite being steep-sided, and consequently having little hydroseral development, the aquatic and semi-aquatic invertebrate fauna contains a large number of interesting and scarce species amongst several families of Diptera and Coleoptera. Associated reed-beds support a good *Phragmites* moth fauna and the additional interest of adjacent saltmarsh, shingle and grassland contribute to the variety of this important complex of habitats. Part of the site is managed by the Lincolnshire and South Humberside Trust for Nature Conservation.

8 BECK HOLE WOODS (NZ 8201) - This site incorporates a series of valley woodlands on the northern edge of the North York Moors. Most of the woods are shady and humid with an acidic ground flora and an abundance of fungoid dead wood. Boggy hollows and flushes are frequent and there are some open areas of acid grassland. There is little current information available on the invertebrate fauna but earlier this century several nationally scarce beetles associated with damp woodland habitats were recorded. The fauna is unlikely to have deteriorated since then and modern surveys are likely to confirm that this complex contains a good representative fauna of damp valley woods in the Region.

9 BELTINGHAM GRAVELS (NY 786640) - An area of river shingle on the south bank of the River South Tyne, bordered by a strip of mixed woodland. A rich fauna is associated with the riparian habitats, including the very local ground beetle *Bembidion schueppeli*. The adjacent woodland adds diversity and shelter to the site and supports a good dipteran fauna, such as the hoverflies *Criorhina asilica* and *Ferdinandea cuprea*. A Northumberland Wildlife Trust reserve.

10 BISHOP MIDDLEHAM QUARRY (NZ 331325) - A steep-sided, disused, Magnesian

Limestone quarry with herb-rich calcareous grassland on the quarry floor. The typical limestone fauna includes a good colony of the northern brown argus *Aricia artaxerxes*. There are old records of both species of hornet clearwing, *Sesia apiformis* and *Sesia bembeciformis*, which are presumably associated with the willow scrub established on the southern part of the quarry. The site is managed as a nature reserve by the Durham County Conservation Trust.

11 BISHOP WOOD (SE 5633) - Much of the area now consists of conifer plantation but there are also a few remnants of the ancient oakwood that once covered the site. A mixture of broadleaved trees has also been planted by the Forestry Commission who own Bishop Wood and the mixed age structure, along with a network of open flowery rides, maintains high entomological interest. Phytophagous species are well represented and the remaining areas of old trees harbour some rare woodland insects, including the fly *Xylomia marginata* and the net-winged beetle *Pryopterus nigroruber*.

12 BLACKHALL CLIFFS (NZ 4639) - Steep limestone cliffs with herb-rich coastal grassland and flushes. Several colonies of the northern brown argus *Aricia artaxerxes* are present along with a typical northern assemblage of calcareous grassland Lepidoptera. The coastal flushes support an interesting community which includes the rare water beetle *Helophorus dorsalis*. Owned by the National Coal Board and managed by Durham County Conservation Trust as a nature reserve.

13 BLACKTOFT SANDS (SE 8423) - This RSPB reserve consists of a large area of brackish reed-bed at the confluence of the rivers Ouse and Trent, with conditions ranging from tidal reedswamp through to drier stands of reed with invading scrub. The estuarine fauna includes a number of rare beetles and flies along with the reed-bed moths *Archanara dissoluta* and *Chilodes maritimus*.

14 BRASSIDE POND (NZ 2945) - This flooded clay-pit has steep sides overhung with trees but there is a narrow fringe of marginal vegetation on the east bank. Although conditions are not entirely favourable for dragonflies there is a good range of species present, including the locally uncommon brown hawker *Aeshna grandis* and broad-bodied chaser *Libellula depressa*. The nationally scarce soldier fly *Stratiomys potamida* has been recorded recently. Managed by Durham County Conservation Trust as a nature reserve.

15 BRIARWOOD BANKS (NY 793623) - Areas of mixed woodland either side of the River Allen, said to be the last remaining fragment of ancient woodland in the Allen Valley. Several species of beetles indicative of old woodland have been recorded, for example,

Saperda scalaris, Stenostola dubia, Alosterna tabacicolor and *Tetratoma ancora*, along with the old woodland lacewing, *Drepanepteryx.phalaenoides*. A Northumberland Wildlife Trust Reserve.

16 BRIDESTONES (SE 8791) - Part owned by the National Trust and leased to the Yorkshire Wildlife Trust, Bridestones consists of the steep and heavily wooded gorge of Dovedale Griff and the surrounding acid moorland. Much of the invertebrate interest lies in species of northern moors or deadwood in humid woodlands, including the scarce longhorn beetle *Saperda scalaris*.

17 CASSOP VALE (NZ 3438) - A narrow limestone valley, about 2½ kilometres long, containing limestone grassland, scrub and ash woodland. The northern brown argus *Aricia artaxerxes* is present as part of a typical limestone Lepidoptera fauna and the grassland Hemiptera are of regional significance. Old spoil-heaps provide nesting sites for solitary Hymenoptera, with suitable open-ground conditions being maintained by recreational pressures.

18 CASTLEBECK AND SCAR WOODS (SE 9497) - Four kilometres of upland valley draining heather moorland with an extensive oak/birch wood owned by the Woodland Trust at the southern end. The invertebrate fauna includes moorland and damp woodland species along with a number of insects associated with the abundant nests of the northern wood ant *Formica lugubris*.

19 CASTLE EDEN DENE NNR (NZ 4238) - Entomologically one of the best known and richest sites in the North-East Region. The four kilometre stretch of wooded coastal dene cuts through a deep, steep-sided gorge in the Magnesian Limestone in which ash is the dominant tree species and yew is a prominent feature of the understorey. The sides of the gorge are actively eroding and provide open slippage and flushed areas. The upper part of the dene is a shallow valley supporting sessile oak woodland on boulder-clay. Extensive lists for a range of invertebrate groups include a large number of nationally uncommon or rare species.

20 CLAYTON AND CORNELIAN BAYS (TA 0685) - An important stretch of soft-rock coastline where boulder-clay overlying sandstone gives rise to frequent slippages. Herb-rich coastal grassland is established on the more stable areas of cliff and an area of base-rich deciduous woodland occurs at Osgodby Point. Seepages and small pools on the cliff slopes are inhabited by several scarce flies whose larvae develop in the damp margins of such habitats. Unstable sections support a characteristic ground-beetle fauna which includes *Nebria livida*, a rare species of the east coast of England which is here approaching the northern limit of

its British distribution. Part-owned by the National Trust.

21 CHERRY COB/STONE CREEK (TA 194231 - TA 247176) - The site includes the only unreclaimed patches of saltmarsh along this stretch of the north bank of the Humber. The northern section (Cherry Cob) is heavily grazed whilst Stone Creek at the south end is unmanaged with more botanically diverse vegetation. Phytophagous Coleoptera occurring here include several scarce species and the rare water beetle *Graptodytes bilineatus* has been recorded.

22 CLOSE HOUSE (NZ 127658) - Eighteenth century parkland containing the south-facing wooded slopes of the Tyne Valley and the nearby northern bank of the Tyne itself. Ponds and unimproved grassland further enhance site diversity. Close House has been extensively worked because of the presence of a University field laboratory and an impressive species list confirms the invertebrate importance of the Lower Tyne Valley. Amongst many nationally scarce species recorded is the conopid fly *Leiopoldius signatus*. Part of the site, on the banks of the River Tyne below Wylam, is a Northumberland Wildlife Trust Reserve.

23 COATHAM SANDS (NZ 5626) - A narrow dune system on the south side of Teesmouth which includes a full dune succession from embryo dunes through to slacks and old dune grassland. Saltmarsh and a saline lagoon add further diversity. Although this site has serious problems from public pressure it is an important site regionally and continues to support a valuable dune fauna. Recent surveys have indicated that several uncommon coastal ground-beetles and spiders are present and the rare snail-killing fly *Pherbellia grisescens* is common around the wetter slacks.

24 COCKLAWBURN BEACH (NU 034479) - A strip of calcareous grassland developed on the spoil heaps of an old lime-kiln, with young fore dunes developing along the shore. A deep limestone quarry above the shoreline is partially flooded and provides a steep-sided lime-rich pond. A typical coastal Lepidoptera fauna is present and the locally distributed dune robberfly *Philonicus albiceps* occurs. A Northumberland Wildlife Trust Reserve.

25 COLLEGE VALLEY, CHEVIOT (NT 8824) - Steep-sided rocky gorge with remnants of wet woodland on the slopes. Pockets of alder woodland support the scarce leaf-beetle *Chrysomela aenea* and the predatory dance-fly *Empis scotica*. The gravel banks along the edge of the College Burn are inhabited by a range of characteristic river shingle invertebrates.

26 COTTAM WELL DALE (SE 9763) - Unimproved chalk grassland extends for more than

three kilometres on this narrow, steep-sided valley in the Yorkshire Wolds. A colony of the northern brown argus *Aricia artaxerxes* is present and several nationally uncommon beetles have been recorded but there is potential for much further survey work.

27 COWPEN MARSH (NZ 5025) - The only extensive area of saltmarsh left in North-East England between the Humber and Holy Island. A transition from saltmarsh through to freshwater grazing marsh with well-developed ditch systems provides habitat for a range of aquatic invertebrates and several notable water beetles, such as *Ochthebius marinus* and *Haliplus apicalis* have been recorded. Other interesting saltmarsh invertebrates include the bug *Conostethus griseus* and the spiders *Pardosa purbeckensis*, *Silometopus ambiguus* and *Erigone longipalpis*. The site is leased to the Cleveland Nature Conservation Trust.

28 CRONKLEY FELL NNR (NY 8427) - An extensive moorland block which is adjacent to, and comparable with, Widdybank Fell. Blanket mire and base-enriched flushes emanating from pockets of 'sugar limestone' have produced records of a number of uncommon ground-beetles and spiders but further survey effort is desirable.

29 CROWLE WASTE (SE 71) - The eastern section of the expansive estuarine raised mire of Thorne Moors. The Humberside sections consist largely of acidic fen communities which have developed on areas of traditional peat cuttings. Peripheral areas are subject to birch and bracken invasion as a result of drainage but much of the site supports peat baulks with a characteristic mire vegetation between water-filled peat cuttings with stands of cottongrass and bog-moss carpets. The traditional levels of peat extraction have sustained an excellent peatland fauna which includes the ground-beetle *Bembidion humerale* in one of its only two known British localities. Crowle Waste is managed as a nature reserve by the Lincolnshire and South Humberside Trust for Nature Conservation.

30 DANBY/GLAISDALE MOORS (NZ 7001) - The largest remaining area of heather moorland left in the North York Moors, consisting generally of a thin layer of peat over sandstone-derived soils and clays. A typical northern moorland fauna is present along with several nationally scarce species, including the rare cranefly *Tipula serrulifera*. The moors are sheep-grazed and managed for grouse and regular burning maintains populations of *Helophorus tuberculatus*, a rare water beetle which is associated with areas of burnt peat.

31 DERWENT INGS (SE 7046 - SE 7034) - A twelve kilometre stretch of flood meadows on the banks of the River Derwent. Muddy riverbanks, old hedgerow willows and drainage ditches are also of value for invertebrates. This stretch of river is important for its range of nationally scarce wetland beetles and flies and survey amongst other invertebrate Orders

should also be profitable. The rare and declining mud snail *Lymnaea glabra* has been recorded in several locations along the river in recent years. Much of the site is contained within the Lower Derwent Valley NNR and Wheldrake Ings, at the northern end of this stretch of the Derwent is owned by the Yorkshire Wildlife Trust.

32 DODDINGTON BRIDGE (NT 9930) - A kilometre stretch of the River Till which cuts through the glacial sands of a former lake-bed. Fluctuating river levels erode the sandy faces of the banks and leave behind shallow temporary pools during the summer months. A very rich beetle community associated with the sandy substrate is present, including the carabids *Bembidion schueppeli* and *B. litorale* and the water beetles *Georissus crenulatus* and *Orectochilus villosus*.

33 DUNCOMBE PARK NNR (SE 6082) - This relict of the once extensive Ryedale Woods is a National Nature Reserve covering 118 hectares of ancient parkland and deciduous woodland. Duncombe Park is probably the richest site in northern England for invertebrates associated with over-mature trees and the River Rye, which flows through the Park, also has considerable riparian and freshwater invertebrate interest. The occurrence of the four species of flower-beetles *Ischnomera cinerascens*, *I. caerulea*, *I. sanguinicollis* and *Oedemera virescens* together at one site is unique in Britain and the presence of twelve species of longhorn beetles is remarkable this far north.

34 EAST KESWICK FITTS (SE 341461 - SE 357457) - Sand and shingle banks of the River Wharfe with willow carr and tall fen developing on the higher ground away from the river. Shallow, vegetated backwaters add a marshland complement to the fauna. This is one of the best examples of unmodified river shingle in the south of the Region and supports a characteristic assemblage of the specialised invertebrates of such habitats, including the rare empid fly *Platypalpus subtilis*.

35 ELLERBURN BANK (SE 853848) - South-east facing calcareous grassland slope on Jurassic Limestone, managed as a nature reserve by the Yorkshire Wildlife Trust. The site is well known for its diverse butterfly fauna, which includes a small colony of Duke of Burgundy fritillaries *Hemaris lucina*. The rich flora supports many uncommon phytophagous insects such as the cistus forester moth *Adscita geryon* and the beetles *Bruchidius cisti* and *Mantura matthewsi*, all of which feed on rock-rose *Helianthemum* spp.

36 EPWORTH TURBARY (SE 7504) - Blown sand covers part of this peatland site and there are extensive areas of reed-bed and birch woodland. The mire supports several locally uncommon moths and was formerly a site for the large heath butterfly *Coenonympha tullia*,

but the outstanding interest of Epworth Turbary lies in a series of small temporary pools surrounded by willow carr. These contain a rich assemblage of water beetles which includes *Hydroporus rufifrons*, a species which has declined considerably over much of its British range. Epworth Turbary is owned by the Lincolnshire and South Humberside Trust for Nature Conservation.

37 FEN BOGS (SE 854975) - Fen Bogs is a valley fen, situated in a glacial meltwater channel, which has developed over the last 150 years following the drainage of a former reed swamp during the construction of the Pickering Valley railway. The acidic plant communities are dominated by bog myrtle and purple moor-grass with wetter areas containing numerous small pools and stands of cottongrass. A substantial population of the large heath butterfly *Coenonympha tullia* is present and the peatland beetles include the chrysomelid *Cryptocephalus biguttatus* which feeds on cross-leaved heath. Fen Bogs is a nature reserve owned by the Yorkshire Wildlife Trust.

38 FORDON BANK (TA 061748) - A small section of chalk grassland in the Yorkshire Wold with a good representative fauna associated with rock-rose and other calcareous plants. All current invertebrate information relates to the area managed as a nature reserve by the Yorkshire Wildlife Trust and other unimproved remnants nearby would repay further study.

39 FORGE VALLEY NNR (SE 9887) - The steep-sided limestone gorge of the River Derwent is clothed by mixed deciduous woodland with a rich understorey and ground flora. Along the banks of the river are stretches of alder carr and river fen and there are several calcareous springs and flushes. Forge Valley is important for its deadwood fauna and has a good variety of land molluscs, including several species which are strongly associated with areas of ancient woodland. (q.v. Raincliffe Wood).

40 GIBSIDE (NZ 1859) - Gibside was historically regarded as one of the best entomological sites in North-East England, with many rarities associated with the deciduous woodlands of this large estate. Much of the best woodland was clear-felled during the Second World War and then planted with conifers in 1953 but oakwood remnants survive along the banks of the River Derwent and in the steep-sided valley of Snipes Dene. Wide sandy rides in the conifer plantations are important for aculeate Hymenoptera but they are in need of management to maintain this interest. Gibside still has considerable potential for invertebrate conservation but surveys are urgently required to identify the remaining areas of importance.

41 GOSFORTH PARK (NZ 2570) - The former site of Gosforth Lake (now drained), this is the

only extensive reed-bed in Tyne and Wear. Much of the present interest, however, is centred on the mature secondary woodland adjacent to the lake bed which supports a number of uncommon beetles, including the rare fungus-feeding *Triplax scutellaris*. Managed as a nature reserve by the Natural History Society of Northumberland and Durham.

42 GRASS WOOD (SD 9865) - Ash-dominated woodland covers much of this area on thin limestone soils, grading into birch-dominated pasture woodland to the east. Limestone pavement, marshland and calcareous flushes are important features of this habitat complex. The invertebrate fauna reflects the richness of the calcareous ground flora and the variety of edge habitats, with phytophagous species amongst the Coleoptera and Lepidoptera providing many of the more interesting records. Altitude and the southerly aspect combine to produce an interesting mixture of species characteristic of both northern and southern Britain. Grass Wood is managed as a nature reserve by the Yorkshire Wildlife Trust.

43 GUNDALE (SE 8087) - Conifer plantations have fragmented the conservation interest of this Jurassic Limestone valley but several areas of calcareous grassland remain. The short, rabbit-grazed sward supports a diverse flora with a rich associated fauna. Historically, the deciduous woodland of the valley bottom produced records of several nationally rare beetles and remnants of the deciduous woodland in the lower valley may still be important. At the northern end, a long narrow exposure of soft sandstone provides breeding sites for a variety of bees and wasps and is of regional significance for this aspect of the fauna.

44 HARBOTTLE MOORS (NT 9004) - An extensive area of dry heather moor on the fell sandstone with small streams and flushes. The Lepidoptera have been well-studied and a number of uncommon moorland species, such as large heaths *Coenonympha tullia*, grey scalloped bar *Dyscia fagaria* and scarce silver Y *Syngrapha interrogationis*, have been recorded. Included within the site is a small natural upland lake, Harbottle Lough, which has a good aquatic invertebrate fauna and a specimen of the rare scatophagid fly *Erononeura argus* (which is otherwise known only from stony lake shores in Scotland) was found here in 1980. Part of the site is a Northumberland Wildlife Trust reserve.

45 HART BOG (NZ 4535) - Although completely surrounded by arable land, this undisturbed kettlehole fen has retained considerable invertebrate interest and is one of the richest sites in the Region for water beetles. Of particular significance is the presence of the very rare species *Hydroporus scalesianus* which is known from few other sites in Britain. The total of thirty-three water beetles recorded includes a number of other nationally uncommon species, including *Laccornis oblongus* and *Ilybius guttiger*.

46 HAWTHORN DENE (NZ 4245) - A coastal wooded dene in the Magnesian Limestone belt with areas of limestone grassland near the mouth. Records indicate that a good range of species typical of the coastal denes is present and this is a good example of this restricted habitat-type. Hawthorn Dene is a Durham Trust for Nature Conservation reserve.

47 HAXEY GRANGE FEN (SK 737972) - A small area of fen which contains several important, seasonally-flooded, pools and a small block of birch woodland. The fluctuating water levels result in margins of bare peat around the pools during the summer, supporting a characteristic ground beetle community which includes *Blethisa multipunctata* and several uncommon species of *Bembidion*. The entomological interest of this site has only recently been recognised and further survey is recommended.

48 HESELDEN MOOR WEST (NZ 3845) - A small remnant of lowland heath in an industrial setting, consisting of humid heath on acidic boulder clay and grading into willow carr and a small area of fen. Underworked entomologically but recent information suggests that a rich fauna has survived despite disturbance and fragmentation.

49 HETTON BOG (NZ 3844) - Valley fen and wet woodland with a series of calcareous springs emerging from the Magnesian Limestone. The presence of three uncommon species of solder-flies, including *Oxycera nigricornis*, is indicative of a rich, well established wetland and this site would repay further detailed survey.

50 HIGH FORCE NNR (NY 8828) - The Teesdale juniper wood is a classic entomological site and there is a long tradition of recording. The area supports an upland, alpine fauna and most of the northern Lepidoptera associated with juniper are present.

51 HOLYSTONE VALLEY (NT 935011) - The valley of the Holystone Burn and surrounding woods and moorland, including bog myrtle flushes on the open slopes and a stand of ancient neglected coppice. Nests of the northern wood ant *Formica lugubris* dominate much of the area and exert a strong influence over the invertebrate fauna of the open woodland. This composite site supports a range of uncommon insects, with the hoverflies *Cheilosia pubera* and *Orthonevra geniculata* amongst the rarer inhabitants. Much of the valley is a Northumberland Wildlife Trust reserve.

52 HORNSEA MERE (TA 1846) - There is a long history of entomological study at Hornsea, the last remaining example of the Holderness meres. The large, shallow lake is fringed by reed-beds and sallow carr and these marginal habitats support a diverse fauna with many

nationally scarce species. The site is owned by the Royal Society for the Protection of Birds.

53 HORSLEYHOPE RAVINE NNR (NZ 0549) - Extensive, undisturbed sessile oakwoods on the steep slopes of the River Derwent and Horsleyhope Burn. Damper areas towards the river support a more mixed canopy and there are stands of alder along flush-lines. The site is not as well surveyed as other woods in the lower Derwent Valley but the available information suggests that a fauna indicative of little modified ancient oakwoods is present. The brown lacewing *Hemerobius perelegans* occurs here at one of its few known English sites and there are records of a number of uncommon species of Lepidoptera and Coleoptera.

54 INGLEBOROUGH NNR (SD 77) - The National Nature Reserve of Ingleborough covers a variety of habitat components associated with this upland limestone block, including montane grassland, limestone pavement, blanket mire, calcareous grassland, ash woodland and juniper scrub. The invertebrate fauna is correspondingly diverse with a high proportion of northern and upland species recorded from most of the major invertebrate groups.

55 IRTHING GORGE (NY 6369) - Steep, partially wooded gorge of the River Irthing. The river has an exceptional water beetle fauna, including *Hydraena pulchella* and *H. rufipes*, but other aspects of the invertebrate fauna of the site have not been studied. The area is potentially interesting for the fauna of upland woodlands and is deserving of further survey effort.

56 KELD HEAD SPRINGS (SE 787844) - A small area of lush marshland surrounding a series of constant temperature calcareous springs on the outskirts of Pickering. Many species of flies associated with aquatic margins, including the rare sciomyzid *Dichetophora finlandica*, have been recorded and a colony of the small eggar moth *Eriogaster lanestris* is present. Part of the site is managed as a nature reserve by the Yorkshire Wildlife Trust.

57 KILTON WOODS (NZ 7018) - Mixed deciduous woodland on the dene slopes of Kilton and Hagg Becks, amounting to some seven kilometres of valleyside woodland. Relatively little worked but there are indications of a rich and varied woodland fauna. Spiders and molluscs have received most attention and several species characteristic of undisturbed woodland are recorded.

58 KIPLINGCOTES CHALK PIT (SE 9143) - A disused chalk quarry with surrounding calcareous grassland managed by the Yorkshire Wildlife Trust. The south-facing aspect of this small reserve is beneficial for many of the typical chalk invertebrates and the mixture of open scree and grassland adds to the site's importance.

59 LANGDALE (SE 99) - The upper reaches of the River Derwent with acid moorland around the headwaters and mixed deciduous woodland in the lower gorge. A typical northern upland and woodland fauna is present and the nests of the northern wood ant *Formica lugubris* support a good diversity of uncommon myrmecophilous invertebrates. The river itself is fairly shallow with numerous shingle beds and earth banks with a characteristic fauna of unpolluted watercourses.

60 LANGDON COMMON (NY 8433) - Part of the Upper Teesdale moorland and containing extensive areas of upland grassland and blanket mire. Upland specialities are present amongst the spiders, ground beetles and craneflies and the rare leaf beetle *Hydrothassa hannoveriana*, which feeds on marsh marigold *Caltha palustris*, has been recorded.

61 LEVEN CANAL (SE 04) - The rich emergent and aquatic vegetation of this disused canal is probably a relict of the former Holderness mere through which the canal was dug. The invertebrate fauna is correspondingly rich with seven species of reed beetles having been recorded and a colony of the red-eyed damselfly *Erythromma najas* is present.

62 LINDISFARNE NNR (NU 095434) - The island contains the best dune system on the east coast of England north of Spurn Head on the Humber. Seasonally flooded slacks support a diverse dune flora and there is good fore dune development along the northern shore. A characteristic lepidopteran fauna is present, including coast dart *Euxoa cursoria*, Portland moth *Ochropleura praecox* and sand dart *Agrotis ripae*. Although extensive, the saltmarsh has limited botanical diversity but nonetheless contains a representative assemblage of Diptera. Surprisingly the site is rather under-worked for many invertebrate groups and further surveys are desirable.

63 MALHAM ESTATE (SD 86) - This is one of the best studied entomological sites in Britain and the impressive list of rare species recorded reflects both the level of recording and the high quality of many of the component habitats of this extremely varied complex. The juxtaposition of upland limestone, mixed plantation woodland, calcareous fen, ombrotrophic mires and the shallow marl lake of the Tarn is a unique combination and of outstanding regional and national importance. Although most of the habitat elements have yielded significant records, the richest areas are probably Tarn Fen, Tarn Moss and Malham Tarn with its inflow stream. The Malham Estate is owned by the National Trust and managed jointly with the Field Studies Council.

64 MANTON AND TWIGMOOR (SE 90) - A large complex of heaths, mires and acidic

woodland on Coversand which includes two well-vegetated lakes. The Lepidoptera have been reasonably well studied and several heathland specialities have been recorded, most notably the scarce vapourer *Orgyia recens*. This is potentially a very important site and information on other invertebrate groups would be of great value.

65 MESSINGHAM SAND QUARRY (SE 9003) - Adjacent to the previous site, this is an area of flooded sand workings and remnant heath which is managed as a nature reserve by the Lincolnshire and South Humberside Trust for Nature Conservation. A strong colony of the scarce vapourer *Orgyia recens* is present and the pools and associated reed-beds support species such as the variable damselfly *Coenagrion pulchellum* and the silky wainscot moth *Chilodes maritimus*.

66 MUCKLE MOSS (NY 7966) - An ombrotrophic valley mire, containing a series of deep, peaty pools, adjacent to a large area of rough moorland. A representative acid mire fauna is present with several uncommon species of Lepidoptera and Coleoptera. This is a good dragonfly site with well-established populations of *Sympetrum danae* and *Orthetrum coerulescens* and the extensive water beetle list includes the rare peatland species *Ilybius aenescens*.

67 NEWHAM FEN NNR (NU 167294) - A small basin fen which is established on a spring line from an adjacent glacial esker and receives enrichment from the calcareous till. An open central area of *Phragmites* and *Carex* fen is surrounded by birch and willow carr. Scarce species amongst a range of invertebrate groups have been recorded and, with eleven species present, the fen is regarded as the best dragonfly site of the Region. National rarities include the snail-killing fly *Dichetophora finlandica* and the dark bordered beauty moth *Epione parallelaria* has a good population on creeping willow, and possibly birch scrub, here.

68 NEWTONDALE (SE 88) - This large glacial spillway valley cutting through the heather moorland plateau of the North York Moors is extensively planted with conifers but contains examples of semi-natural habitats such as acidic deciduous woodland, base-rich marshes and boggy mires. The complex is an important butterfly site with northern moorland species as well as those of calcareous grassland and the beetle fauna of the old woodlands is also of interest. The valley mire of Fen Bogs (q.v.) is situated within Newtondale.

69 NEWTON LINKS (NU 243245) - A section of tall coastal dunes with some small slacks. There is a small area of saltmarsh at the northern end of the site. Several species of moths with a restricted coastal distribution occur, including the least minor *Photedes captiuncula*, shore wainscot *Mythimna litoralis*, Portland moth *Ochropleura praecox* and coast dart

Euxoa cursoria. Strandline wrack beds support an interesting dipteran fauna and there are also records of a number of uncommon flies from the margins of Newton Pool to the south (NU 250223). This stretch of coast is owned and wardened by the National Trust.

70 OTLEY WHARFE BANK (SE 202460 - SE 228459) - A three kilometre stretch of the River Wharfe, upstream from East Keswick Fitts. Earth cliffs, fringing alders and willows, and shingle deposits support an important riparian fauna with many national rarities, particularly amongst the dolichopodid and empid flies.

71 PADDOCK HILL WOOD (NZ 1760) - A complex of steep deciduous woodland with a mixed canopy, sandy banks of the River Derwent and unimproved damp meadows. The invertebrate fauna has elements of interest in each of these habitat-types including several ancient woodland beetles and flies. Paddock Hill Wood is owned by Gateshead Metropolitan Borough Council and managed as a nature reserve in conjunction with Thornley Wood and Derwent Walk Country Park.

72 PEN-Y-GHENT (SD 8373) - Disturbance from walkers and the exposed nature of the summit limits the fauna in comparison with some of the other Pennine peaks. However, at 690 metres, the summit of this limestone hill capped with gritstone supports several scarce montane beetles and spiders which shelter beneath the abundance of small stones amongst the exposed grassland, including the rove beetles *Eudectus whitei* and *Anthophagus alpinus*.

73 POCKLINGTON CANAL (SE 799472 - SE 709443) - Approximately sixteen kilometres of disused canal with some open sections and other stretches are partly choked with aquatic and emergent vegetation. Dragonflies and reed beetles are well represented and this is considered to be one of the best aquatic habitats in Yorkshire.

74 PRESTWICK CARR (NZ 1974) - Remnant peat bog surrounded by seasonally flooded rough pasture with a relict aquatic fauna surviving in ditches and peat cuttings. There have been problems with a reduced water table on this site but an interesting water beetle fauna persists and there are also records of locally uncommon and nationally scarce ground beetles and moths.

75 RAINCLIFFE WOOD (SE 98) - A large area of mixed deciduous woodland adjacent to the northern end of Forge Valley NNR (q.v.). In the 1930's and 1940's many rare species of beetle associated with fungoid conditions and deadwood were recorded but the site has been largely neglected entomologically in recent years. Surveys are necessary to determine how much of the invertebrate interest remains, following partial coniferization in the 1960's

and 1970's. Owned by Scarborough District Council and managed in conjunction with the Nature Conservancy Council.

76 RIPON PARKS (SE 3075) - A complex of habitats alongside the River Ure containing Magnesian Limestone grassland, marshes, scrub woodland, ponds and river shingle. The fauna includes nationally scarce species typical of all of the major habitat components and the rare amber snail *Succinea oblonga* is present. Ripon Parks is owned by the Ministry of Defence.

77 RISBY WARREN (SE 9313) - Risby Warren consists of several square kilometres of open grass heath on the glacial Coversands with damp hollows and springs. The sands are still mobile in places, forming inland dunes, and rabbits help to maintain open conditions. Ruderal vegetation is important for phytophagous invertebrates and as a nectar source for the diverse fauna of bees and wasps. The fauna includes a number of sand loving species that are scarce in inland habitats.

78 RIVER DERWENT (SE 8897 - SE 6828) - An unpolluted and relatively unmodified tributary of the Ouse which rises on the North York Moors and flows southwards, gaining a calcareous influence from the Howardian Hills and the Yorkshire Wolds. Much of the river has a rich aquatic and marginal flora and the invertebrate fauna reflects both the clean water conditions and the quality of the macrophyte vegetation. See also - Derwent Ings, Forge Valley NNR and Langdale.

79 ROSS LINKS (NU 1337) - An extensive dune system between Budle Bay and Holy Island mud flats with herb-rich slacks and high, fixed dunes. Despite problems with cattle grazing and stock feeding on some of the more accessible slacks there is an interesting invertebrate fauna present on this dune system, including the rare picture-winged fly *Opomyza punctella*. The coastal robber fly *Philonicus albiceps* is abundant in bare, sandy areas and a good range of spider-hunting wasps occurs.

80 RYTON WILLOWS (NZ 1564) - Three spring fed ponds with extensive marginal fen communities adjacent to valleyside secondary woodland. There is a long history of interest in the aquatic invertebrates present and this is one of the best sites on Tyne and Wear for water bugs and water beetles, including *Ilybius guttiger* and *I. subaeneus*. Most of the site is owned and managed by Gateshead Metropolitan Borough Council.

81 SEAHAM BAY (NZ 4443) - Coastal limestone cliffs with calcareous grassland and areas of bare slippage. The northern brown argus *Aricia artaxerxes* has several discrete colonies

along this stretch of coast and the characteristic lepidopteran fauna includes such species as the least minor *Photedes captiuncula* and the chalk carpet *Scotopteryx bipunctata*. Wet hollows and base-rich flushes add further interest to the site.

82 SEATON SANDS (NZ 5328) - As with many of the north-east coast dune systems, Seaton Sands suffers from heavy public pressure and threats from industrial development but, despite this, a good dune invertebrate fauna manages to persist. Examples of the full dune succession are present from fore dune through to slacks and dune meadow. A colony of the lyme grass moth *Photedes elymi* is present and other nationally scarce invertebrates occur amongst the ground beetles, spiders and flies.

83 SHIBDON POND (NZ 1962) - Present information suggests that this is the best wetland site in Northumbria with several nationally rare flies associated with the reed-bed and wet meadows. Shibdon is a subsidence pond fed from adjacent springs and drained by a tidal, and slightly brackish, ditch. Extensive beds of *Typha* and *Glyceria maxima* dominant the marginal fen and herb-rich grassland adds further interest. Managed by Durham County Conservation Trust as a nature reserve.

84 SHIPLEY & GREAT WOOD (NZ 0021) - An ancient woodland complex on the steep slopes of the Tees valley, dominated by ash and wych elm with a rich understorey and field layer. Acidic sessile oakwood and floodplain carr add further diversity. The area is little known entomologically but a number of rare species have recently been recorded, including a large population of the nationally scarce soldier fly *Oxycera pardalina* which breeds amongst mosses on a dripping, calcareous cliff face.

85 SKIPWITH COMMON (SE 63) - A large area of lowland wet and dry heath on the glacial sands of the Vale of York with shallow ponds in old peat cuttings, mature oak woodland and birch scrub. The fauna of the wet heaths and fens is particularly important and includes many invertebrate species which are rare in the Region as a whole, notably the water beetle *Acilius canaliculatus* and several species of wetland spiders. Skipwith Common is managed by the Yorkshire Wildlife Trust.

86 SOUTH CLIFFE COMMON (SE 83) - A large area of rabbit-grazed sandy heathlands with sparse birch scrub, mature mixed woodland and numerous wet hollows containing poor fen. There is considerable invertebrate interest in all of the major habitat components and surveys of the Coleoptera, Hemiptera and Araneae have demonstrated the presence of many nationally scarce species.

87 SPURN HEAD (TA 396106 - TA 410157) - A six kilometre long sand spit jutting southwards into the mouth of the Humber Estuary. Parts of this dynamic system are continually being eroded by the sea and as sections are lost it is difficult to know how much of the historical interest of the site remains. Much of the entomologically rich reed beds at the mainland end have been lost to the sea but the remaining sand dunes, saltmarsh and earth cliffs retain an exceptional fauna which includes many species at the northern limit of their British range from several invertebrate orders. Spurn Head is a reserve of the Yorkshire Wildlife Trust.

88 STAWARD WOODS (NY 8058) - The steep-wooded valley of the River Allen, consisting mainly of oak-birch woodland interspersed with conifer plantations and alder-dominated flushes. At the confluence of the East and West Allen there are extensive gravel beds backing onto willow scrub and lush riverside vegetation. The woodland Lepidoptera have been well surveyed and a number of locally scarce moths are recorded. The river gravels support several rare spiders which are specialists in this type of habitat - notably *Centromerus persimilis, Diplocephalus connatus* and *Caviphantes saxetorum*.

89 STRENSALL COMMON (SE 65-61) - An exceptionally rich heathland fauna occurs on this substantial relict of the Vale of York heaths. The range of habitats contains a combination of damp, peaty heathland, drier heath with localised patches of bare sand, boggy pools and peaty drains and scrubby birch woodland. Invertebrate interest extends throughout the range of habitat types with particular significance attached to the wetland, scrub and bare sand faunas. Strensall Common is owned by the Ministry of Defence and part-leased to the Yorkshire Wildlife Trust.

90 TARN DUB (NY 853287) - A small tarn formed by a glacial moraine which impedes drainage from the adjacent Whin Sill scarp of Cronkley Fell. A number of uncommon upland water beetles are present along with the rare water snail *Lymnaea glabra*. Natural fluctuations in water level provide extensive marginal habitats for semi-aquatic invertebrates. Situated within the Upper Teesdale NNR.

91 THIXENDALE & LONG DALE (SE 8561) - Several kilometres of unimproved chalk grassland valley in the Yorkshire Wold with a rich flora, variable aspect and areas of scrub. There is little information available for groups other than the Lepidoptera but the presence of species such as the forester *Adscita statices* and reddish light arches *Apamea sublustris* moths along with a colony of the northern brown argus *Aricia artaxerxes* suggests considerable potential. Further survey is required but it can be anticipated that this will be amongst the best of the Yorkshire Wold grasslands for invertebrates.

92 THORNLEY WOOD (NZ 1760) - Thornley is regarded as the best remaining block of woodland in the lower Derwent Valley. It is an extensive sessile oakwood in a steep-sided dene on dry, acidic sandstone soils but also containing wet flushes and open, scrubby grassland. The fauna includes the characteristic, north-eastern, woodland ground beetle *Pterostichus cristatus* and the scarce wood-edge robberfly *Dioctria oelandica* amongst a good range of nationally uncommon invertebrates. Owned and managed as a nature reserve by Gateshead Metropolitan Borough Council.

93 THRISLINGTON PLANTATION (NZ 3132) - Probably the best example of Magnesian Limestone grassland in Britain, supporting a full range of invertebrates characteristic of this habitat. Studies on the effects of transplanting grassland turves have provided valuable information on the sensitivity of invertebrates to such measures.

94 TIMBER BEACH (NZ 36-58) - Situated well up the estuary of the River Wear, this is the only decent, but small, remnant area of saltmarsh left in Durham County. The fauna includes such saltmarsh species as the long-legged fly *Dolichopus diadema* and the ground beetle *Dicheirotrichus gustavi*. The saltmarsh grades into reedswamp and the steep slope of the riverbank above has hawthorn and willow scrub. Owned by Sunderland Borough Council and leased to Durham County Conservation Trust as a nature reserve.

95 TOWN KELLOE BANKS (NZ 3537) - Unimproved Magnesian Limestone grassland on the steep slopes of a glacial outwash channel. The cattle-grazed slopes support a rich herbaceous flora and characteristic invertebrate associates. A colony of the northern brown argus *Aricia artaxerxes* is present and the scarce linyphiid spider *Tapinocyboides pygmaea* has recently been recorded. This site is managed by the Durham County Conservation Trust as a nature reserve.

96 UPPER HUMBER FLATS AND MARSHES (SE 82) - A linear stretch of saltmarsh and reed bed extending as a narrow fringe for some eight kilometres along the north bank of the Humber. A representative saltmarsh fauna includes a strong population of the rare ground beetle *Dromius longiceps* and the chloropid *Eurina lurida* has been recorded.

97 WALDRIDGE FELL (NZ 2449) - Historically well-known as an important area for heathland and wetland Lepidoptera but underworked for most other invertebrate groups. This complex of wet and dry heathland, acidic fen and alder carr is subject to heavy recreational pressure and further entomological surveys are desirable.

98 WATERSMEET (NY 9166) - River banks at the confluence of the North and South Tyne

with seasonally flooded herb-rich meadows and a strip of mixed canopy deciduous woodland. Sandy river gravels are inhabited by an interesting range of nationally scarce ground beetles, including several species of *Bembidion*, and the floristic diversity of the riparian grassland supports several uncommon species of phytophagous beetles.

99 WELWICK SALTMARSH (TA 3318) - This is the largest remaining area of saltmarsh on the northern bank of the Humber and is actively expanding. There is little current invertebrate information available but habitat structure suggests that this under-worked site has good potential and many of the interesting species recorded in the past, such as the staphylinid *Carpelimus halophilus*, should still be present.

100 WHARRAM QUARRY (SE 858653) - This large, south-west facing, chalk quarry has been extensively studied by Hull and York Universities. The combination of chalk scree, pioneer grassland, and established chalk grassland contains a number of nationally scarce invertebrates, particularly those associated with short turf or pioneer communities. The weevil *Omias mollinus* is present and a small colony of the marbled white butterfly *Melanargia galathea* has become established in recent years. Wharram Quarry is a nature reserve of the Yorkshire Wildlife Trust.

101 WIDDYBANK FELL NNR (NY 82-29) - Upland moorland and blanket bog in Upper Teesdale, rising to 523 metres a.s.l. This area is well known for the relict arctic-alpine element of its flora and the mollusc *Vertigo genesii*, which inhabits base-rich flushes, is also thought to be a glacial relict. The varied geology of the area contributes much to its richness and the juxtaposition of acidic blanket mire and limestone grassland is of particular importance. Scarce species of moorland insects occur amongst the Lepidoptera, Coleoptera and Diptera but this extensive area still has plenty of scope for further survey.

102 WINGATE QUARRY (NZ 37-37) - Under threat from substantial public pressure, including motorbike scrambling, this disused limestone quarry nonetheless continues to support an interesting invertebrate fauna. A feature of particular interest is the presence of several small ponds which have a number of uncommon beetles and flies living around their boggy margins.

103 WITTON-LE-WEAR (NZ 1631) - This site, which is owned by the Durham County Conservation Trust, consists of a series of old gravel pits, floodplain alder carr, and the sandy banks of the River Wear. The flooded gravel pits are an important aquatic habitat and contain a good range of dragonflies for the area.