# Durham Magnesian Limestone Natural Area Profile

# Contents

**Figures**



**Tables**

# Summary


1. The Natural Areas of England are distinguished by characteristic physical and ecological features. The Durham Magnesian Limestone Natural Area (DMLNA) covers just over 44,000 ha of south-east Tyne & Wear and East Durham.

2. The character of the DMLNA is dominated by its underlying Permian Magnesian Limestone which exerts a strong influence on soil types and vegetation communities. Along the western edge of the Natural Area lies a broken yet locally-prominent limestone escarpment where soils are thin and terrain steep. The East Durham plateau dips gently eastwards from this scarp towards the limestone sea cliffs of the Durham coast where glacial drift deposits are thicker and the local climate milder. Areas in the south of the DMLNA are characterised by thick deposits of glacial boulder clay and fertile soils. The coastal sea cliffs and extensive quarries combine to expose both internationally and nationally important examples of the Permian magnesian limestone series.

3. Although the DMLNA is dominated by arable farmland and pasture, a number of semi-natural wildlife habitats do remain. The key habitat feature which characterises the Natural Area is the occurrence of unimproved magnesian limestone grassland on shallow rendzina soils associated with the escarpment and plateau. This habitat is nationally rare and includes all the remaining examples of an internationally unique grassland type. Other calcareous grasslands, with basic mires, occur along the Durham Coast and abandoned limestone quarries colonized by a typical limestone flora further contribute to the limestone grassland resource. Almost two-thirds of all magnesian limestone grassland in Britain is found within the DMLNA. Small areas of unimproved neutral grassland are also found, for example to the north of the area on the Wear floodplain and on boulder clay along the cliff-tops. Extensive areas of ancient magnesian limestone woodland are found along the deeply incised coastal denes and these support a rich assemblage of invertebrates and flowering plants. Wetland habitats within the Natural Area are widespread but most are of very limited area or comparatively recent origin, reflecting past pressures from agricultural drainage and urbanisation. The best sites tend to be restricted to the edges of the DMLNA.

4. These habitats are able to support a rich flora and fauna, including species characteristic of both northern and southern areas of Britain. Some eleven nationally-scarce plants and 3 nationally rare species have been recorded in the Natural Area in the recent past; these include a number found on the very edge of their range. Invertebrates represent the most significant group for faunal interest in the DMLNA, with 11 nationally rare and 83 nationally scarce species are associated with the area. The moths and butterflies include nationally uncommon species characteristic of unimproved limestone grassland such as the Durham Argus and Cistus Forester. Parts of the coast hold high numbers of breeding seabirds, and extensive arable areas support populations of nationally-declining farmland birds such as the Grey Partridge. Over half of the Great Crested Newt colonies in the region are found in the DMLNA and are often associated with small man-made wetlands. In addition to these two species, a number of other high-profile vertebrates listed in the UK Biodiversity Action Plan occur, notably Skylark, Song Thrush, Pipistrelle and Water Vole. Locally

important populations of Badger and Red Squirrel also occur and the wooded denes support a diverse bird community more typical of western Durham.

5. The DMLNA is essentially agricultural in character and locally dominated by urban areas. Historically, the principal factors affecting the nature conservation resource have been agricultural intensification, quarrying, deep coal mining and urbanisation. These factors have in the past severely diminished the nature conservation resource of the Area and continue to do so. In addition to agricultural improvement, the extent of magnesian limestone grassland has been reduced and fragmented by mineral extraction. The abandonment of working has allowed some natural vegetation decolonisation and produced geological exposures of considerable interest. Other significant threats to the nature conservation interest of the grassland resource are illegal tipping, neglect and lack of positive management, which leads to scrub-development. The more robust woodlands have suffered extensive replanting with non-native species and inappropriate recreational activities at potentially damaging levels, while important coastal habitat types are being damaged by accelerated coastal erosion and eutrophication from fertilizer run-off. As a consequence of habitat loss or a decline in habitat quality, associated species are also affected. Already one-third of butterfly species have been lost from the DMLNA over the last 150 years largely as a result of agricultural intensification. The Durham Argus continues to decline with the loss of limestone grassland habitat. A number of plants characteristic of the Natural Area have also been lost this century.

6. Visionary objectives to maintain and enhance the key wildlife features of the Natural Area are identified.

# 1. Introduction

## 1.1 Background

*Natural Areas* are tracts of land in England with similar types of wildlife and natural features. In many instances they also share similar landscapes. Their boundaries do not follow existing administrative boundaries, but are defined by their wildlife and natural features, their land-use and human history. Natural Areas already provide the framework for much of English Nature's work, and will be used as the basis of our advice to others. This approach has been welcomed by many organisations.

Each Natural Area is supported by a description, or *profile*, of its ecological character, such as that presented for the DMLNA in this document. Crucially, each Natural Area also has a set of long-term *visionary objectives*, resulting from discussions between English Nature and local bodies concerned with Nature Conservation. This will provide a direction for nature conservation and guide action plans and strategies long into the future.

Natural Areas and Natural Area Profiles have been developed in tandem with *Countryside Character descriptions*. These offer an equivalent subdivision of England on the basis of its landscape, and have been developed by the Countryside Commission for similar reasons to Natural Areas - to provide a reasoned approach to the conservation and re-building of the countryside. The two end-products of these approaches - wildlife and landscape - are clearly closely associated, and this has led English Nature and the Countryside Commission to co-operate in the publication of a *joint map*. Broadly speaking, a Natural Area comprises one, sometimes more, countryside character areas, as landscape divisions are often smaller than areas with characteristic suites of wildlife. The Durham Magnesian Limestone Natural Area and Countryside Character Area are, however, contiguous.

The period since 1990 has seen the emergence of a *Biodiversity Action Plan* for the UK, a mechanism to try and focus effort on the conservation and re-building of the full variety of wildlife and its habitat in the British Isles. Of late, the process of translating this national plan into local initiatives has begun. Natural Areas are seen as one way of focusing effort in re-building the different elements of the countryside, by directing it appropriately according to the needs and capacities of different areas; it is reasonable, for example, to focus effort on the conservation of the Great Crested Newt in the DMLNA, as the species is disproportionately represented here. Local Biodiversity Action Plans need to consider Natural Areas in order to ensure that, together, they speak in a logical way for the whole of England.

## 1.2 The Durham Magnesian Limestone Natural Area

### 1.2.1 Definition of Boundaries

The DMLNA covers an area of approximately 44200 ha. It forms a belt across south east Tyne & Wear and East Durham. It straddles 8 local district or borough boundaries, namely South Tyneside, Sunderland, Easington, Durham, Sedgefield, Wear Valley, Hartlepool and Darlington. The boundary of this Natural Area has been broadly defined to coincide with the location of the Magnesian Limestone formation where this lies at or close to the surface.

The DMLNA boundaries are illustrated in Figure 2. The western edge of the area lies partially alongside the A1 before diverting eastwards towards the coast at South Shields. This edge is defined for part of its length by the prominent magnesian limestone escarpment. The North Sea forms about 31km of the eastern boundary which turns inland at Hartlepool, toward Sedgefield and Newton Aycliffe. This southern edge does not follow a defined feature on the ground, but approximates to the 100-metre contour level and broadly represents the southernmost foot of the East Durham Plateau. Between Sedgefield and Newton Aycliffe the boundary is slightly indented to the north-west, as it excludes the floodplain of the River Skerne.

### 1.2.2 General Description

The Natural Area is predominantly agricultural in character, mixing intensive arable production with pastoral farming over the bulk of the East Durham Plateau. Urban areas cover around one-fifth of the DMLNA and includes the population centres of Sunderland, Peterlee and Newton Aycliffe, while industrial use past and present is illustrated by the widespread presence of quarries and spoil heaps. Those semi-natural habitats that remain are sparse and scattered throughout the Area, although two major concentrations occur along the Magnesian Limestone escarpment and the Coast. Nationally important areas of calcareous grassland are predominantly restricted to the steep magnesian limestone escarpment and plateau where soils are shallow and free-draining. The coastal zone represents a significant feature of the Natural Area and is characterised by features such as unique paramaritime limestone sea cliffs, wooded valleys and small areas of calcareous mire. An extensive, linear sequence of important calcareous grassland can also be found here. Faunal interest includes a number of nationally and regionally scarce species, such as the Durham Argus butterfly. The geological interest of the DMLNA is considerable in both a national and international context.

There are currently 3 National Nature Reserves or NNRs (with a fourth planned for declaration in 1998), and approximately 48 Sites of Special Scientific Interest (SSSIs) within the DMLNA. These are the most important places in terms of their biological and geological importance. Of these, 6 SSSIs are currently managed as county nature reserves by the Durham Wildlife Trust. In addition, 4 Local Nature Reserves and approximately 132 "second-tier" sites (Sites of Nature Conservation Importance and County Wildlife Sites) are located within the Natural Area. Two sites within this Natural Area, Castle Eden Dene NNR and Thrislington Plantation NNR have also been proposed as candidate Special Areas of Conservation (SACs) under the European Habitats Directive (EC, 1992), highlighting their international significance.

## 1.3 Physical Characteristics

### 1.3.1 Geology

Magnesian limestone is a form of limestone which contains a variable amount of magnesium carbonate (less than 15%) in addition to calcium carbonate. The solid geology of the magnesian limestone formation in Britain covers only 1.5% of mainland UK and extends to approximately 1200 km² (Dalby, 1991). It lies as a narrow discontinuous strip stretching from Nottinghamshire northwards into Yorkshire, Durham and Tyne & Wear. As 90% of this limestone is obscured by glacial drift deposits, surface outcrops only cover 0.15% of mainland Britain, the majority of which are found within the DMLNA.

**Formation**

Magnesian limestone derives from sedimentary processes dating from the Permian period 240 million years ago (Pettigrew, 1980). The geological history of the DMLNA is complex and represents a significant chapter in the geological evolution of Britain. Permian magnesian limestone rocks occupy the whole area of the DMLNA and it is this solid geology which has led to the establishment of a number of characteristic vegetation communities. It also forms the basis of the considerable geological interest of the Natural Area. A brief summary of this geology is included here.

At the beginning of the Permian, Britain formed part of a large equatorial land mass subject to a hot and arid climate. Early desert deposits of the Lower Permian sands and sandstones were overlain with more carbonate-rich material following a rise in sea level and the submergence of the Lower Permian dune systems by the Zechstein Sea. These sediments were to form the Lower Magnesian Limestones and covered older Carboniferous Coal Measures Slumping within the sea and the subsequent creation of a sub-marine reef allowed the accumulation of organic siliceous and calcareous material within a shallow lagoon (Smith, 1970). A cycle of successive sedimentation within this offshore lagoon as a result of the episodic rising and falling in sea level led to the formation of a series of lagoonal Middle Magnesian Limestones. Early deposits were calcium-rich but as the period progressed, dolomitisation occurred where some calcium carbonates were replaced with magnesium carbonates, forming the series of Upper Magnesian Limestones. These deposits have been divided into three distinct formations:-

1. Concretionary limestones and 'cannonball' rock

2. Hartlepool and Roker dolomites

3. The Seaham formation

The features of the concretionary limestones infer their formation in highly saline deep water. A fall in the level of the Zechstein Sea then created the shallow water deposits of more dolomitic limestones, followed by the deposition of dissolved salts known as the Fordon Evaporites as sea level continued to rise and hypersalinisation ensued. Another later influx of oceanic water occurred on a much smaller scale and left deposits which were to be the final layers of magnesian limestone, or the Seaham Formation. By the end of the Permian period (225 million years ago), the gradual encroachment of desert conditions led to the infill of the entire Zechstein Sea basin, firstly by additional layers of evaporites and then by Triassic mudstones and sandstones.

### 1.3.2 Geomorphology

The evolution of the DMLNA landscape owes a great deal to the effects of glaciation. The Natural Area is thought to have been influenced by at least one Quaternary glaciation and was the confluence of a number of ice sheets derived from Scandinavia, the Cheviots and the Lake District. Glacial activity during the Devensian period removed much of the magnesian limestone deposits that lay to the west of County Durham, revealing the coal seams and shales of the Wear Lowlands. The retreat of the last major ice sheet did however leave a marked escarpment and plateau in East Durham and covered most of the region in drift deposits or

boulder clay. This Permian magnesian limestone ridge denotes much of the western edge of the DMLNA. Unlike most of the Natural Area, the steep scarp slopes are mostly free of drift deposits, allowing the magnesian limestone to outcrop at the surface. Consequently, areas of magnesian limestone grassland tend to be concentrated on steep, drift-free terrain. Limited exposures of the Carboniferous Coal Measures associated with the Wear Lowlands occur at the foot of the escarpment along this western edge of the Natural Area.

The East Durham Plateau which slopes gently eastwards to the coast is characterised by a thin cover of glacial drift deposits overlying the magnesian limestone, although in places, surface exposures are evident. Along the coastal zone, the soft erosible magnesian limestone sea cliffs denoting the eastern edge of the Area are subject to active coastal geomorphological processes and exhibit a number of typical features associated with cliff retreat and marine deposition. The onset of deglaciation allowed the erosion of more pronounced drainage lines into the magnesian limestone to produce steep-sided postglacial gorges, or coastal 'denes' .

South of the Natural Area, land is generally low-lying and covered with glacial drift up to 100 feet thick. Here in the Tees Lowlands, drainage is effected by the Skerne and ultimately the Tees, flowing through postglacial alluvial and lacustrine deposits.

In the Sunderland section of the Natural Area a small proportion of the low lying Tyne-Wear floodplain occurs where the River Wear cut into the thick clay - dominated drift deposits of the Tyne-Wear Complex.

Anthropogenic landforms are widespread throughout the Natural Area as a consequence of extractive industries, especially mineral extraction. Limestone quarries (most of which are now abandoned) cover almost 1% of the DMLNA and some now possess considerable nature conservation importance due to their magnesian limestone vegetation and geological exposures.

### 1.3.3 Topography and Drainage

The main features of the DMLNA are the marked Magnesian Limestone ridge to the west and the gentler slopes of the East Durham Plateau. The much dissected escarpment overlooks the Wear Lowlands to the west and averages heights of 150-180m along its length, reaching a maximum of 196m in the southwest of the Area. From here, the landscape dips gently eastwards to the coast, ending with a line of soft limestone sea cliffs which vary in height along their length. This roughly triangular area known as the East Durham Plateau incorporates the core area of the DMLNA. The coastal belt of the plateau is also characterised by steep-sided valleys or denes which are generally under woodland cover. At the northern and southern extremities of the DMLNA, the landscape is generally flat and low-lying, usually below 120m. The drainage pattern of the DMLNA is largely radial. The southern area of the DMLNA falls largely within the Tees catchment, whilst the Wear affects drainage of the northern half of the Area. To the east, the coastal burns flow eastwards into the North Sea.

### 1.3.4 Climate

Durham is part of the East Coast lowlands forming one of the driest regions of North-east England (Smith, 1970). Within the lee afforded by the Pennines to the west, the Natural Area has a relatively cool, dry climate, with a mean annual average rainfall of 635-700mm and

about 120 wet days per annum. Mean annual maximum temperatures can reach 26C with relatively mild winters. The length of the growing season in the lowlands of Durham is around 220 days pa (Graham, 1988), lasting 50 days longer than that of western Durham. This is subject to considerable local variation as a result of aspect, late frost and long snowlie. Along the coast, the North Sea administers a cooling effect on this part of the Area and sea mists can reduce the total hours of sunshine over the coastal belt, occasionally penetrating inland to depress air temperatures in summer.

### 1.3.5 Soils

Alexander (1980) identified a complex pattern of 9 major soil types within the Natural Area. These are principally influenced by the underlying geology, topography and climate. Over 75% of the area is covered by moderately permeable glacial drift, resulting in a dominance of gleyed soil types. On the drift-free escarpment are scattered areas of shallow calcareous rendzinas and brown earths derived directly from the underlying parent material.

1. Rendzinas - found on higher summits of the Escarpment and steep slopes where magnesian limestone is exposed at the surface and where glacial drift deposits are thin. These soils also occur at scattered localities over the East Durham Plateau. This type has a high base status with a pH above 7 and are typically free-draining and shallow. These soils characteristically support an abundance of lime-loving plants and are directly associated with most of the remaining areas of limestone grassland.

2. Brown calcareous earths - over limestone parent material at the base of steep slopes where glacial drift is thicker. Typically well-drained, these deep calcareous soils produce the best grade of agricultural soils within the area.

3. Typical brown earths - Well drained soils over non-calcareous parent rock, linked to glacial deposits, noticeably in the vicinity of the Ferryhill Gap. More mesotrophic in nature, this soil type can be agriculturally productive given appropriate management.

4. Stagnogleyic brown earths - these soils tend to develop where drainage is impeded, for example over the medium textured clay loam till which cover extensive areas to the north and east of the DMLNA. Showing a moderate pH, they produce a vegetation similar to mesotrophic brown earths but can also support hydrophilous species. Potentially fertile.

5. Cambic stagnogleys - occur where topography is subdued and drainage poor as a result of poor soil structure on clay loams. Prone to seasonal waterlogging and periodic gleying, land use is restricted to permanent pasture. Common over thicker drift deposits of the Tees Lowlands towards the south of the Natural Area.

6. Cambic-Humic-Alluvial gleys - areas with a high groundwater table such as the Wear and Skerne floodplains with alluvial or lacustrine deposits. Also found in poorly drained hollows created within drift deposits. Due to their state of semi-permanent waterlogging with a neutral pH, these soils are often limited to summer grazing.

7. Peat - occurs in the lowest areas of alluvial and lacustrine deposits of the southern section of the Natural Area. This soil type is now restricted to small irregular areas.

8. Raw sands - limited to unstable skeletal soils along the Durham Coast north of Hartlepool. These soils are very mobile and susceptible to windblow, yet only penetrate less than a hundred yards inland.

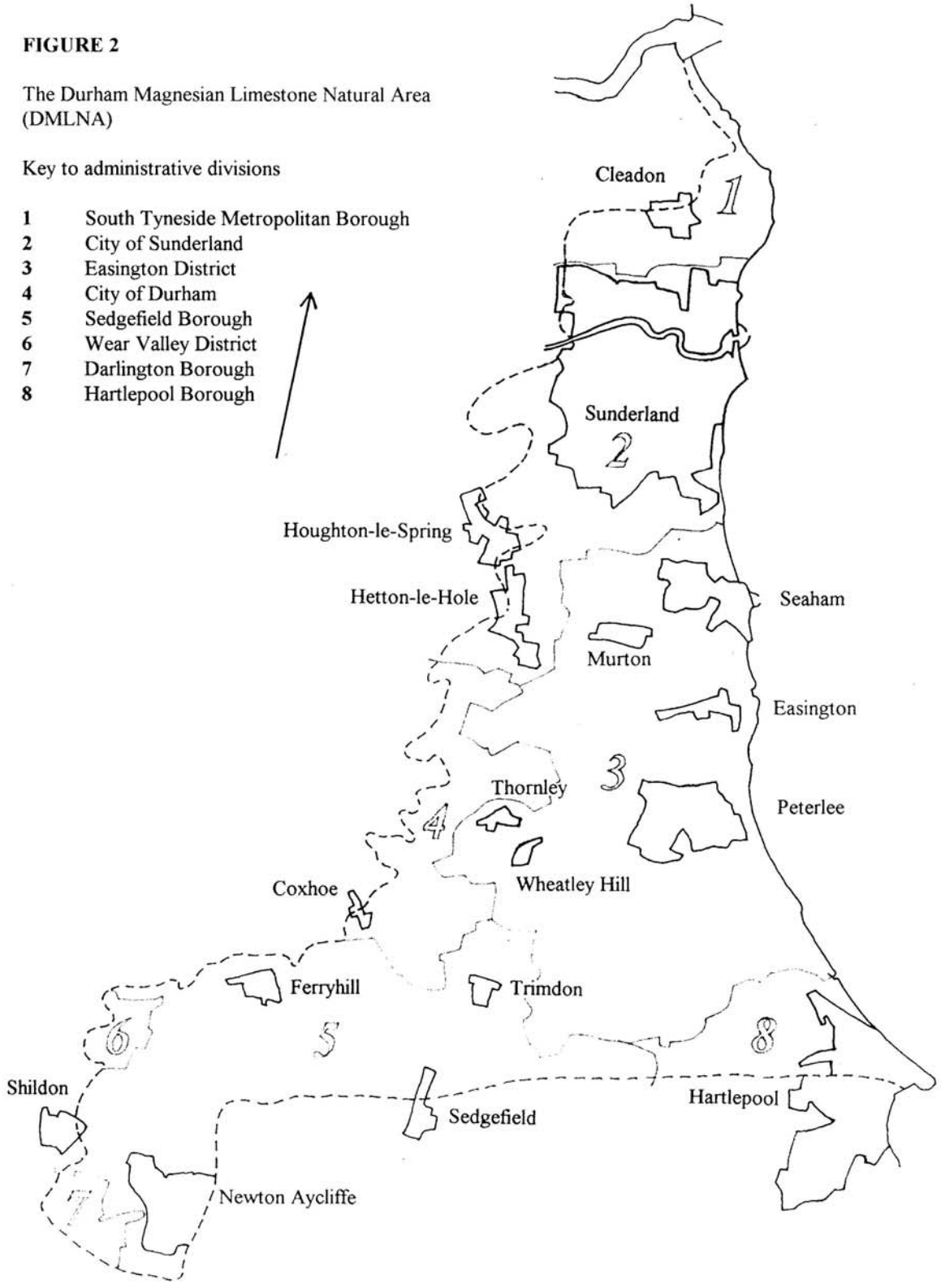
9. Raw alluvial soils - poorly developed soils limited to the valley floors of the major river systems within the Area.

**FIGURE 2**

The Durham Magnesian Limestone Natural Area (DMLNA)

Key to administrative divisions

**1** South Tyneside Metropolitan Borough
**2** City of Sunderland
**3** Easington District
**4** City of Durham
**5** Sedgefield Borough
**6** Wear Valley District
**7** Darlington Borough
**8** Hartlepool Borough



# 2. The Nature Conservation Resource

## 2.1 Vegetation

### 2.1.1 General Summary

A total of 49 broad habitat types have been recognised within the DMLNA using the Phase I habitat classification (NCC, 1990; English Nature, 1994). Figure 3 illustrates the overwhelming predominance of agriculture as the primary land use, with arable land and improved grassland covering 65% of the Natural Area. Built-up areas and the associated areas of amenity grassland between them occupy around 25% of the Natural Area, emphasising the presence of a considerable human population. Although it is generally scarce in Northeast England, covering just 5% of Durham and Tyne & Wear (Cooke, 1987), woodland covers 3.6% of the Natural Area. Nature conservation interest usually lies with broad-leaved semi-natural woodland, which forms 23% of this woodland resource. Coastal habitat types are another characteristic feature, covering only 0.6% of the area, but spread out along the 40 km of the eastern, coastal margin. Grassland is also an important element of the conservation resource, occupying 2.6% of the Natural Area and of particular interest are the calcareous grassland communities. Wetlands are limited in extent, but more widespread than is sometimes supposed. The industrial past of the DMLNA is illustrated by the presence of abandoned quarries and spoil heaps which cover almost 1% of the Area and are locally common along the magnesian limestone escarpment and plateau. A number of these quarries possess both biological and geological interest.

### 2.1.2 Habitats and Communities of Nature Conservation Importance

Figure 4 illustrates the proportion of Phase I habitat types currently represented within the SSSI series of the DMLNA (Hedley *and others.* 1994). This can be used to highlight the relative importance attached to the SSSI habitat types within the Natural Area and illustrates that unimproved calcareous grassland and semi-natural broadleaved woodland are amongst the most represented habitats.

#### 2.1.2.1 Grassland

**Unimproved Calcareous Grassland**

This habitat type covers only 336 ha (0.76%) of the DMLNA but is arguably the most important element of its nature conservation resource. Most stands occur as small, fragmented units across the Western scarp and along the coastal zone on shallow calcareous rendzina and brown earth soils. In the DMLNA, these magnesian limestone grasslands support a rich calcicolous flora including many species at or near the limit of their ranges in Britain, those restricted to limestone soils and associates of old, unimproved pasture (Doody, 1981).

Magnesian limestone grassland is a nationally scarce habitat type (NCC, 1989, Keymer & Leach, 1990) and is included within Annex I of the EC Habitats and Species Directive as a habitat type of Community Interest (EC, 1992). Within the national SSSI series, the total resource of magnesian limestone grassland is limited to 279ha, of which 66.7% lies within Durham and Tyne & Wear (see Figure 6) and falls wholly within the DMLNA. The remaining examples of this grassland are almost without exception small and highly

fragmented, and in fact the extent of grassland habitat-loss and fragmentation probably exceeds that shown by almost all the other lowland limestone escarpments in Britain.

The geographical position of the magnesian limestone reflects its ecological characteristics. Extending northwards from Nottinghamshire into Durham and Tyne & Wear, this formation acts as an ecological bridge in that it straddles a climatic divide separating the chalks and Jurassic limestones of the south and the northern Carboniferous limestones. Consequently the grassland types which occur on the magnesian limestone in the DMLNA are in many ways intermediate between upland and lowland limestone grassland communities, producing a unique assemblage of both northern and southern species (Dalby, 1991).

It is important to be clear about terminology when discussing Magnesian Limestone grassland. To avoid confusion, it is suggested that the term be reserved for grasslands which are calcicolous (lime-loving) in the sense of the recently-published National Vegetation Classification (NVC), as discussed below. In the past the term has also been used to describe the essentially neutral grassland type of MG5, within which there may be a greater or lesser component of calcicolous broad-leaved herbs, but this usage confuses by being unspecific, and undermines the rarity and distinctiveness of both strictly calcicolous grasslands and unimproved neutral grasslands over clay.

Within the Natural Area, "true" magnesian limestone grassland can thus be regarded as comprising 4 distinct plant communities. Of greatest interest are those with a high frequency of the nationally scarce Blue Moor-grass *Sesleria albicans,* viz CG8 *Sesleria albicans-Scabiosa columbaria* grassland community of the National Vegetation Classification (Rodwell, 1992). Other constants here include Sheep's Fescue *Festuca ovina* and Quaking-grass *Briza media*, along with Wild Thyme *Thymus praecox,* Bird's-foot Trefoil *Lotus corniculatus*, Slender St John's-wort *Hypericum pulchrum* and Rockrose *Helianthemum nummularium*, whilst the "preferentials", which essentially distinguish these lowland Blue Moor-grass communities from related forms in the Pennine uplands, include Greater Knapweed *Centaurea scabiosa*, Kidney Vetch *Anthyllis vulneraria* and Upright Brome *Bromopsis erectus.* A number of other diagnostic or "key" species, some of which are nationally scarce or on the edge of their British range occur within this community. These include the nationally scarce Dark-red Helleborine *Epipactis atrorubens* and Bird's-eye Primrose *Primula farinosa.* Mountain Everlasting *Antennaria dioica,* Butterwort *Pinguicula vulgaris*, Grass-of Parnassus *Parnassia Palustris* and Lesser Clubmoss *Selaginella selaginoides* are (or were) associated with the latter species in several places. Reaching their northern limit are Upright Brome, Tor-grass *Brachypodium pinnatum*, Pale St John's-wort *Hypericum montanum*, Yellow-wort *Blackstonia perfoliata* and the nationally-scarce and endemic Perennial Flax, *Linum anglicum* (Doody, 1981). Southern orchids are also represented such as Bee Orchid *Ophrys apifera* and Fly Orchid *O.insectifera*.

The CG8 community is restricted to East Durham and Tyne & Wear within the British Isles (Rodwell, 1992) and is unique to this Natural Area in a European context (Shimwell, 1968). It is probably the rarest lowland calcareous grassland type in Britain, with recent English Nature surveys suggesting a total of less than 65ha in all. It is most characteristic of the steep drift-free slopes along the Durham escarpment and East Durham Plateau on shallow immature rendzina soils that are rich in calcium. The finest example is found at Thrislington NNR, an SAC site which supports the most extensive stand of primary magnesian limestone grassland in Britain (Ratcliffe,1977). The *Sesleria - Scabiosa* community type occurs at scattered

localities as unimproved pasture such as this and elsewhere as secondary grassland which has developed over many decades within abandoned limestone quarries. Quarries contain a significant proportion of magnesian limestone grassland generally (Richardson *and others*. 1980) and one-fifth of magnesian limestone grassland SSSIs in the DMLNA are disused quarries (Pritchard, 1989).

The second community represented within magnesian limestone grassland is CG2 *Festuca ovina - Avenula pratensis* grassland*;* this community is associated with free-draining calcareous brown earths or rendzinas and has a typically southern distribution in Britain. In the cooler climate of the Natural Area, many of its typical southern components are absent, and in fact an under-representation of northern CG2 samples from within the NVC has meant that stands in the DMLNA do not fit well into the national scheme of sub-communities. The community forms a major component of the vegetation of the Durham Coast, where it is largely restricted to steeply-sloping cliffs with a southerly aspect. It is somewhat atypical here in the over-representation of certain maritime species, such as Sea Plantain, *Plantago maritima*. Inland, it can occur in similar situations to the *Sesleria-Scabiosa* grassland, but more sparsely, perhaps where the soils are somewhat less calcareous and nutrient-poor.

CG3 *Bromopsis erectus* grassland is also a community typical of Southern limestones; it reaches its northern limit within the Natural Area, with a small stand occurring on a bank within the predominantly neutral grassland of West Farm Meadows, north of Boldon. It occurs at a number of other sites within the DMLNA eg, Thrislington and Tunstall Hills, but seldom forms stands of more than a few tenths of a hectare. As with *Festuca-Avenula* grassland, far-northern samples of this vegetation type were omitted from the NVC and as a consequence, stands on the DMLNA are perhaps undervalued as they appear atypical and often species-poor. However, a rich stand occurs in the south of the area at Fishburn Grassland, growing alongside *Sesleria* grassland.

Lastly, CG6 *Helictotrichon pubescens* grassland is present sparsely within the DMLNA, though the stands which are present are probably more typical of this vegetation nationally than is the case for the preceding two types. *Helictotrichon* grassland is characteristic of damp, more mesotrophic soils than any of the preceding types, but is important as a typical and therefore valuable component of the suite of grassland types present in the DMLNA. Good examples occur at Moorsley Banks SSSI and Dabble Bank CWS (both in association with CG2 and both associated, as is often the case nationally, with periglacial head), and at Penshaw Hill SNCI. Many of the coastal slopes of the Durham Coast SSSI, where not scrub-covered or supporting CG2 vegetation on south-facing gradients, hold a grassland type rich in Red Fescue (*Festuca rubra*), but with *Helictotrichon* species and a range of calcicoles. It is likely that, although atypical, many of these areas are most closely-related to this grassland type.

The secondary grasslands which have colonised abandoned quarries often do not seem to fit any of these classifications; they may hold open vegetation rich in broad-leaved herbs but lacking the diagnostic calcicolous grasses, or be dominated by Quaking-grass (*Briza media*) and Glaucous Sedge (*Carex flacca*).

All told, magnesian limestone grassland communities are present on almost all of the biological SSSIs within the Natural Area (see Table 1 and Figure 5), collectively representing the greatest concentration of such sites in Britain.

**Neutral Grassland**

Neutral grassland associated with mesotrophic brown earths and gley soils cover 1.75% of the DMLNA. Examples of nature conservation interest, that is species-rich examples with a long history of management as pasture or meadow, are scattered extremely sparsely across the drift-covered plateau, especially along the coastal fringe. Most of this resource - in fact an even greater proportion than is the case for calcareous grasslands - has been subject to agricultural improvement in terms of drainage, artificial fertilisation and conversion to arable cultivation. Consequently, though once highly typical, species-rich unimproved neutral grassland is rare in the Natural Area. Other examples of neutral grassland, notably the unimproved but unmanaged stands of road verges, are widespread but usually of considerably lesser interest.

Sites such as Hawthorn Meadow, South Hylton Pasture, Boldon Pasture, Hesledon Moor East and Captain's Well have remained free of intensive agriculture and support plant communities indicative of traditionally managed meadows and pastures. The most typical and abundant components of these species-rich grasslands are Red Fescue *Festuca rubra*, Crested Dog's-tail *Cynosurus cristatus*, Common Bent *Agrostis capillaris* and Sweet Vernal Grass *Anthoxanthum odoratum.* Characteristic herbs of these grasslands include Hay-rattle *Rhinanthus minor*, Knapweed *Centaurea nigra*, Pignut *Conopodium majus*, Pepper-saxifrage *Silaum silaus,* Lady's Mantles *Alchemilla* spp, Great Burnet *Sanguisorba officinalis* and Adder's-tongue Fern *Ophioglossum vulgatum*. These lowland meadows and pastures of the MG5 *Cynosurus cristatus - Centurea nigra* grassland community are locally and nationally scarce (Rodwell, 1992), as a consequence of their susceptibility to agricultural improvement. Such grassland is also uncommon in a European context and has been listed as a habitat type of Community Interest worthy of conservation under the European Community Habitats and Species Directive (EC, 1992). Despite this, it is probably fair to say that such grasslands are under-represented in the SSSI series within the DMLNA, perhaps because their value has been consistently overshadowed by that of the unique calcareous grasslands, and also because local examples are particularly fragmented and prone to the inappropriate or under-management which so undermines their interest. Of SSSIs in the DMLNA, only about 10% hold neutral grassland interest, but the figure for second-tier sites is much higher.

**Acid Grassland/Heath**

Acidic habitats are a particularly interesting but extremely rare feature within the Natural Area. Their interest stems from the fact that acidic vegetation on lowland southern and eastern limestones generally is extremely uncommon, being restricted to those scattered patches of sandy drift which are unimproved and substantial enough to support an acidic flora. These cover only about 0.01% of the Natural Area, and include woodland, grassland and even heathland vegetation. Tiny vestiges of acid grassland occur along the coast with better-developed sites inland in the centre of the DMLNA between Thornley and Hetton-le-Hole (see Figure 7). Notable is Elemore Golf-course; a superb site at Oxclose was destroyed as recently as c 1995. Haswell Wood, a birchwood of recent origin, also has an acidophilous ground-flora. Ludworth Pit-heap, in the same area, holds a comparatively large stand of heather which has developed on a secondary site, presumably from primary heathland nearby which has now probably been lost. An excellent site occurs at Hesledon Moor West SSSI where heathland is best developed, and even holds a little *Sphagnum*-moss. The presence of

Globeflower *Trollius europaeus* reveals the influence of the limestone beneath, however.

### 2.1.2.2 Broadleaved Semi-Natural Woodland and Scrub

Pollen analysis in Durham suggests that most of the DMLNA was under woodland cover up to 7000 years ago (Bartley *and others,* 1976). Deforestation for agriculture over the centuries led to the removal of most of this resource. Woodland habitat loss in the northeast of England has continued up to the present day. The current broadleaved semi-natural woodland resource amounts to 0.84% of the Natural Area, only 371 ha. This habitat type is now restricted to woods that have largely survived agricultural pressures and as a result often have a continuous history of at least 400 years. There are approximately 20 ancient semi-natural (ASN) woodlands within the DMLNA (Cooke, 1987), many of which are concentrated along the steep-sided coastal denes (Figure 8). Although the unique *Sesleria* grasslands are perhaps the most diagnostic feature of the DMLNA, in terms of area these ASN woodlands are the largest single type of semi-natural habitat present.

One such woodland is found at Castle Eden Dene National Nature Reserve, the most important woodland on the magnesian limestone in Britain (Ratcliffe, 1977). It is the largest and biologically richest area of ancient semi-natural woodland in the Natural Area, covering 193ha. The most significant factor affecting the woods of the Natural Area is soil pH and the predominantly calcareous substrate exerts a strong influence on woodland type. Castle Eden Dene and most of the ASN woods in the Natural Area are dominated by ash *Fraxinus excelsior* and wych elm *Ulmus glabra* - often now moribund - on the rendzina and calcareous brown earth soils exposed within the steep valleys where they grow. Yew *Taxus baccata* can also be abundant in places, while the shrub layer of such woods are often diverse, dominated by hazel *Corylus avellana* and hawthorn *Crataegus monogyna*. Most of the magnesian limestone woodlands can be classed as W8 *Fraxinus excelsior - Acer campestre-Mercuralis perennis* woodland types (Rodwell, 1991) but as with the *Sesleria* grasslands, the W8 woodlands of the DMLNA contain a suite of species at their northern limit, for example Spurge-laurel *Daphne laureola*, Spindle *Euonymus europaeus*, Small-leaved Lime *Tilia cordata* and Field Maple *Acer campestre.* Local geological variation and management history can produce a mosaic of woodland communities. For example at Castle Eden Dene where areas of free-draining glacial drift occur, W13 *Taxus baccata* woodland can predominate. This woodland community has also been recognised as an internationally important habitat type (EC, 1992). Examples of W6 and W7 alder *Alnus glutinosa* woodland are common along the damp valley floor, with W8 ash woodland along the steeper base-rich slopes and W10 *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland on higher, free draining brown earth soils (Williams, 1989). On disturbed areas sycamore *Acer pseudoplatanus* is often an abundant coloniser of secondary woodland and is an increasingly frequent component of magnesian limestone woods generally in the DMLNA. The ground flora of such woods also tend to be species-rich, with ramsons *Allium ursinum*, dog's mercury *Mercurialis perennis* and wood anemone *Anemone nemorosa* abundant. Species of particular note include herb paris *Paris quadrifolia*, bird's-nest orchid *Neottia nidus-avis* and hart's-tongue fern *Phyllitis scolopendrium*.

A number of other sites, smaller than Castle Eden Dene, but still of considerable size, combine to form an important series of coastal magnesian limestone woodlands. These include Hawthorn Dene, Ryhope Dene, Crimdon Dene and Seaham Dene.
Ancient semi-natural woods inland on the magnesian limestone are much more localised as a result of extensive agricultural improvements over the centuries. A few small hanger

woodlands occur on the scarp, comprising Penshaw Wood, Herrington Hill Wood, Elemore Wood, Heugh Hall Wood and woods at Cassop Vale and Ferryhill Cut. These also hold the typical limestone ashwood, although the stands tend to be less structurally complex and species-poorer than the coastal denes. Herb-paris *Paris quadrifolia* at Cassop Vale indicates an ancient origin. Woodlands on the open plateau are rare and almost never ancient; where ancient woodland does occur as at Carr Wood or Thornley Dene, they are for the most part W8 ashwoods in poor condition associated with the sides of shallow dry valleys that penetrate the plateau; the oakwoods one might expect on the neutral drifts which blanket the limestone appear to have been almost completely destroyed, other than where they occur as a thin belt on the shoulders of the incised denes, as mentioned above, and perhaps at Blakeney Woods south of Sunderland, the canopy of which been very modified by planting.

Scrub covers approximately 0.5% of the Natural Area and is frequently encountered within the DMLNA as an intermediate stage of natural succession from grassland to ash woodland. Hawthorn scrub is particularly common on shallow rendzinas, along with hazel, whereas privet *Ligustrum vulgare* and creeping willow *Salix repens* can form low scrubby areas along the coastal belt. One shrub of particular note is the nationally scarce dark-leaved willow *Salix myrsinifolia*, which is found amongst damp woodland along the coast and occasionally colonises limestone quarries. The flora of wild roses has been well studied and is known to be locally diverse. Scrub in association with calcareous grassland and semi-natural woodland is often important to invertebrates and birds.

#### 2.1.2.3 Wetlands

Wetland habitats within the DLMNA are widespread and more common than is often supposed, but almost all are small and those of any national significance are scarce (Wheeler, 1980). There is nevertheless a considerable variety, which comprises flushes, ponds and a reservoir, open-water transitions to swamp, and topogenous fens and marshy-grasslands. There are even two well-developed basin-mires of varied chemistry in the south of the DMLNA. Agricultural drainage and urbanisation have been responsible for the loss of much ancient wetland habitat. However, new wetlands, of increasing value to wetland species, have developed as a result of extractive industries and related subsidence, or sometimes through deliberate efforts to create wetland habitat for wildlife. All told, this varied suite of new and ancient wetlands significantly contributes to the nature conservation resource of the Natural Area (Figure 9). Habitats such as open water, swamp vegetation, fen and flush cover just 128 ha or 0.28% of the DMLNA. Comparatively few are directly associated with magnesian limestone; most tend to occur on areas of drift although a calcicolous element to the flora is often discernible.

Open water in the form of ponds is uncommon, but such sites are well-distributed across the whole of the area, including the claylands of the south-east where irregularities in the thick drift have allowed wetlands to develop over time, even though most other habitats of significance are absent. No ponds are sufficiently typical or well-developed or species-rich to merit notification as SSSI, although it should be noted that Durham lacks a recent systematic amphibian survey (a major reason behind pond SSSI notification) even though several ponds on the DMLNA are known to hold Great Crested Newts. Ponds of particular significance include Mill House Pond and the Wellfield Brick Ponds. Many of the ponds in the area are clearly of recent origin, although it is most common to find some fringing swamp vegetation, and in some instances, lack of management has caused this to occlude the open water. In the south of the DMNLA lies Hurworth Burn Reservoir, a feature somewhat unique to the area as

here defined, and consequently of local importance for species depending on such habitat, notably wildfowl.

Topogenous fens comprise both swamps and marginal vegetation developed around, and sometimes completely infilling ponds, as well as mires or marshes restricted by the topography in other ways, such as within valleys or shallow depressions. There is a great variety of these. At one end of the spectrum is the ancient, unusual and highly natural basin mire of Hart Bog, lying over thick clays in the south of the DMLNA, whose core, with true rain-fed bog vegetation, makes it an extremely rare and irreplaceable site. At the other end are the more typical swamps and marshes, often associated with wetlands of more recent origin, which crop up throughout. These tend to hold widespread and unspecialised plant communities mostly harbouring common species, although many are often of greater value to animals, especially invertebrates, than the vegetation might suggest. A valley fen, probably the largest single expanse of swamp and aquatic vegetation in the DMLNA, occurs at Ferryhill Carrs. Developed within a narrow valley originating as a glacial meltwater channel in the escarpment, this holds swamp of Reed *Phragmites australis*, Reedmace *Typha latifolia* and Bur-reed *Sparganium erectum*, grading to rich fen with Meadowsweet *Filipendula ulmaria* on the one hand and aquatic emergent communities such as those with Mare's-tail *Hippuris vulgaris* on the other.

A third category of wetlands is soligenous fens or flushes. Because all limestones are permeable, flushes are generally situated on the periphery of the limestone, at its junction with an impermeable rock beneath it. Flushes are a very typical but comparatively rare feature of the DMLNA. On the coast, flushes emerge on the cliff-faces at several points along its entire length. Those at Blackhall Rocks are among the more important, housing the only population of Bird's-eye Primrose *(Primula farinosa)* on the Durham Coast, together with the slightly more widespread Butterwort (*Pinguicula vulgaris)* and the uncommon moss (*Gymnostomum recurvirostrum*). A similar community occurs around an unusual spring-head inland near Castle Eden; There is some evidence that such communities were more widespread even until recently, but that drought over recent decades has led to their decline. On the main escarpment, flushes emerge at scattered localities such as Cassop Vale, Grimestone Banks and along the Penshaw to Pallion railway. Perhaps the most classic site, where flushes give way to a varied topogenous fen further downstream, is at Hetton Bogs SSSI, a site with a character essentially intermediate between the DMLNA and the adjacent Northumbrian Coal Measures Natural Area. Here springs emerge in cushions of the moss *Cratoneuron commutatum*, before giving rise to rich tall-herb fen dominated by Great Willow-herb *Epilobium hirsutum* and Meadowsweet *Filipendula ulmaria* with many other wetland species, including Marsh Valerian *Valeriana dioica*. There are also fens of *Carex* and flushed marshy grassland with Northern Marsh-orchid *Dactylorhiza purpurella*, a species present in other flush systems within the natural area. Many flushes appear to have suffered badly in recent years due to a succession of dry summers.

#### 2.1.2.4 The Coast

The coastline of the DMLNA is one of its most important features. Covering an area of approximately 400ha and forming over 40km of the eastern edge of the terrestrial Natural Area, the coastal zone supports a rich diversity of terrestrial habitats with localised maritime influence, although true maritime habitats such as dunes and saltmarsh are largely conspicuous by their absence.

The coastline of Durham has been described as an ecologically distinct area, possessing the only paramaritime magnesian limestone sea cliffs in Britain and indeed Europe (Doody, 1981). The national context of this cliff vegetation is poorly understood, and whilst some of its constituent communities are clearly unusual, other elements are more or less clearly related to various types of mire, or mesotrophic, calcareous and maritime grassland; the term paramaritime grassland is probably best understood as being broadly descriptive rather than precise. The coast also exhibits some of the finest geological exposures of the magnesian limestone in both the Natural Area and Britain. Its national importance is recognised by its notification as a SSSI and the inclusion of 270ha in the Nature Conservation Review as a Grade 2 site (Ratcliffe, 1977). Three other coastal SSSIs occur within the DMLNA, namely Hart Warren Dunes, Trow Point to Whitburn Steel and Seaham Harbour (a geological site). Hawthorn Dene and Castle Eden Dene are primarily woodland sites which also include coastal stretches.

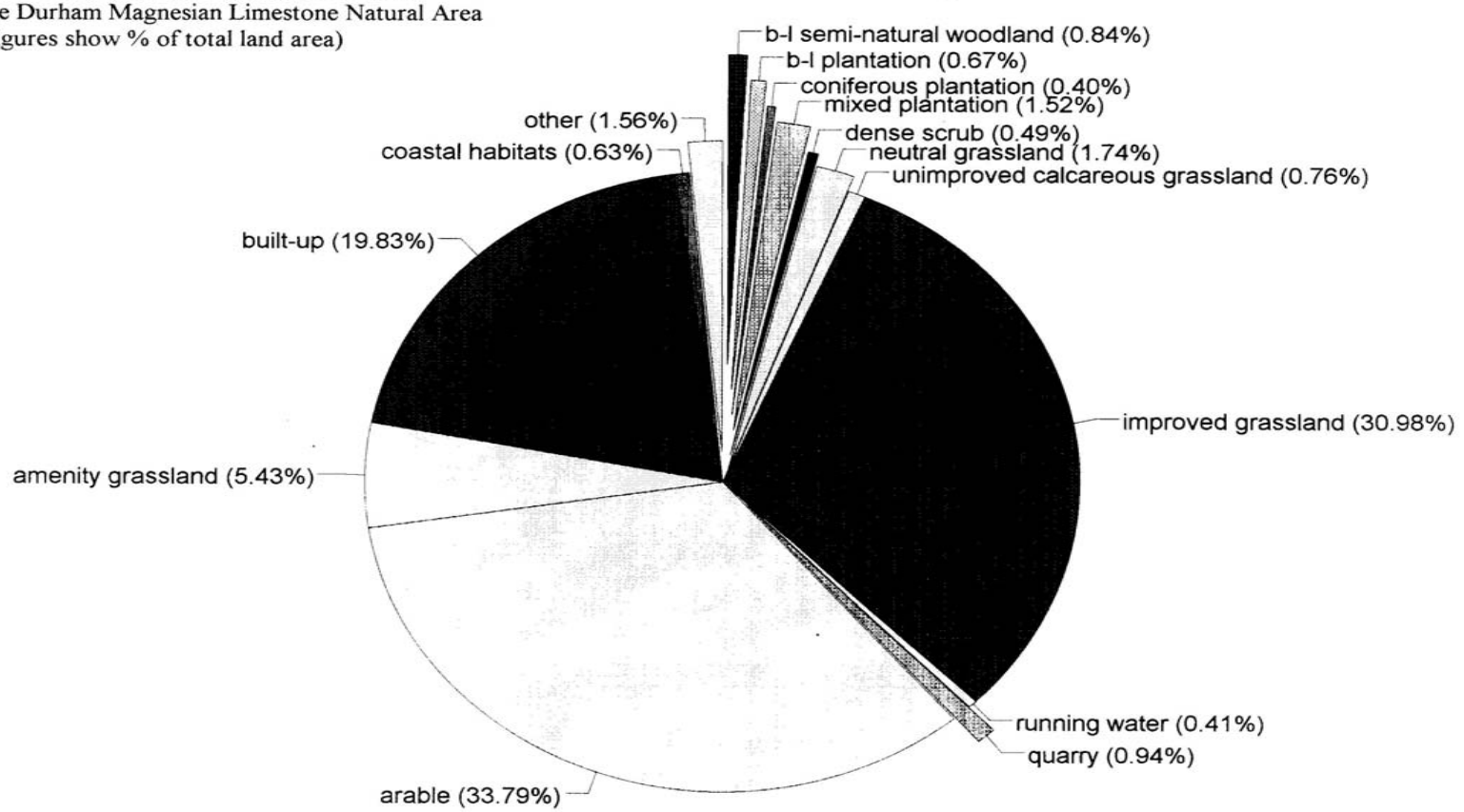
The most significant elements of the coast are the extensive calcicolous and mesotrophic grasslands which have developed over drift covered cliff tops and which are discussed on pp 13-14. These calcareous grasslands are generally dissimilar to the inland types although *Sesleria albicans* does occur close to the coast in one or two places. The more exposed headlands hold small areas of truly maritime grassland overwhelmingly dominated by Red Fescue *Festuca rubra*, with species such as Sea Plantain *Plantago maritima* and Thrift *Armeria maritima*. The steeper cliffs north of Whitburn support a fragmented ledge-flora with Scurvy-grass *Cochlearia officinalis,* but such cliff vegetation is poorly developed in comparison with the more oceanic parts of Britain. A few other truly maritime species occur such as Sea Spleenwort *Asplenium marinum.* Saltmarsh occurs in small quantities along the Wear where it cuts through its gorge in the limestone.

Where the low drift-covered limestone cliffs have slumped seawards, particularly in the vicinity of Blackhall Rocks, a series of wet hollows and seepage pools produce calcareous flush communities which are species-rich and have long been recognised to be significant (Heslop-Harrison, 1923; Wheeler, 1980; Mitchell *and others*. 1994). These wetland communities are thought to be unique in a national context, where species of a predominantly southern and northern British distribution grow together in a series of isolated flush communities (Doody. 1981). They are also notable for the presence of nationally and regionally scarce species such as *Primula farinosa, Samolus valerandi* and *Epipactis palustris* (Graham. 1988).

Small areas of sand dune occur at the very southern tip of the coastal zone forming part of Hart Warren Dunes SSSI. In common with other characteristic vegetation types of the DMLNA, these dunes are calcareous in nature, and they support a plant community almost identical to that developed on the dunes of Northumberland but not found a few kilometres further south in the dunes of Teesside. The characteristic elements of this flora are Bloody Cranesbill (*Geranium sanguineum*), Burnet Rose *(Rosa pimpinellifolia)* and Lesser Meadow-rue *(Thalictrum minus)*. The dune flora becomes increasingly rich inland with good stands of rock rose, bird's foot trefoil *Lotus corniculatus* and spiny restharrow *Onosis spinosa* typical. Very locally small patches of blown sand occur elsewhere, notably at Whitburn Bents and perched on the cliffs at Horden, supporting marram grass *Ammophila arenaria* and sand sedge *Carex arenaria*.

**FIGURE 3**

Land-use and habitat representation within the Durham Magnesian Limestone Natural Area (figures show % of total land area)




From Phase 1 habitat data

**FIGURE 4**

Habitat representation within SSSI in
the Durham Magnesian Limestone Natural Area
(sectors show proportions within the notified SSSI area)

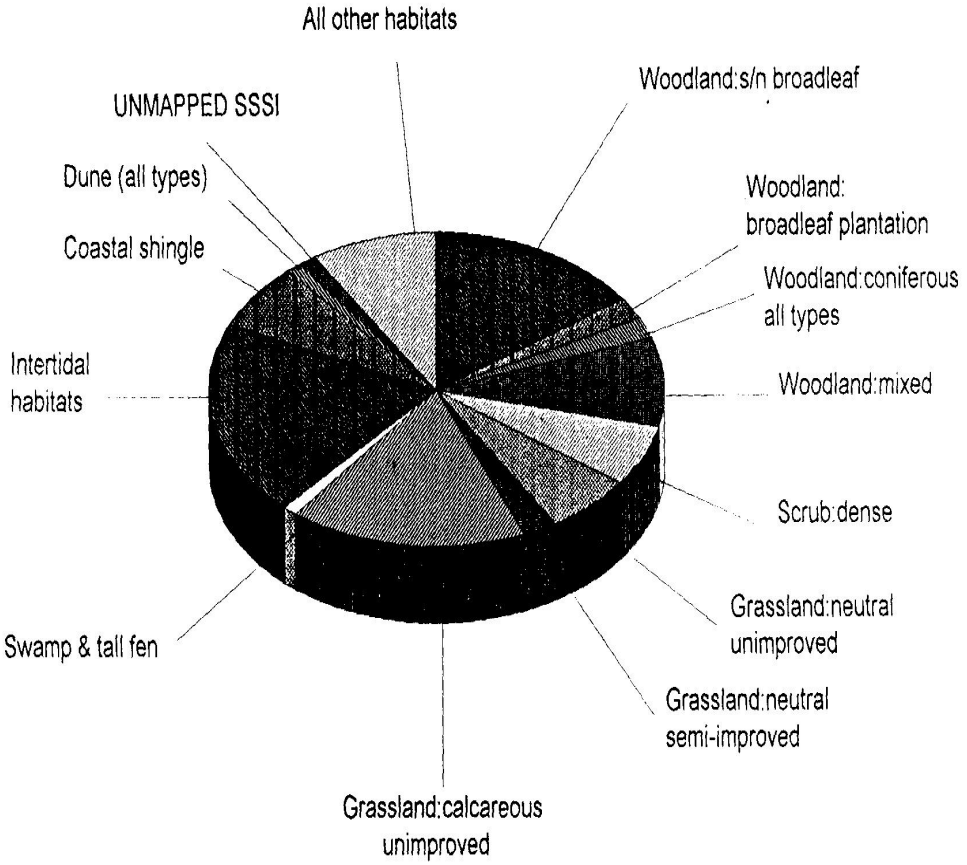


**Table 1** Showing SSSI with Magnesian Limestone Grassland in the DMLNA, and the NVC types present

| Site Name | Total area limestone grassland | Breakdown by NVC type with are (if known) | | | |
|---|---|---|---|---|---|
| | | CG8 | CG2 | CG3 | CG6 |
| Bishop Middleham Quarry | 4.5 | <4.0 | | | |
| Cassop Vale | 5.7 | c.4.0 | | | |
| Castle Eden Dene | 0.5 | 0.5 | | | |
| Claxheugh Rock & ford Quarry | 1.8 | <1.8 | | | |
| Cleadon Hill | 2.3 | | y | y | |
| Durham Coast | 79.6 | | y | | y |
| Fishburn Grassland | 0.5 | 0.43 | | y | |
| Fulwell & Carley Hill Quarries | 2.1 | | | | |
| Harton Down Hill | 0.6 | 0.01 | y | | |
| Hastings Hill | 0.6 | <0.6 | | | |
| Herrington Hill | 4.5 | <4.5 | | | |
| High Haining Hill | 0.9 | 0.01 | y | | |
| High Moorsley | 5.1 | <5.1 | | | |
| Moorsley Banks | 0.9 | | | | y |
| Pig Hill | 6.1 | 6.1 | | | |
| Pittington Hill | 3.1 | <3.1 | | | |
| Raisby Hill Grassland | 1.7 | 1.7 | | | |
| Sherburn Hill | 5.7 | <5.7 | | | |
| The Carrs | 1.8 | 0.01 | y | | |
| Thrislington Plantation | 15.5 | 8.94 | | y | y |
| Town Kelloe Bank | 2.5 | 2.5 | | | |
| Trimdon Limestone Quarry | 0.8 | 0.8 | | | |
| Trow Point to Whitburn Steel | 13.8 | | | | |
| Tunstall Hills & Ryhope Cutting | 4.8 | <4.8 | y | y | y |
| Tuthill Quarry | 5.34 | c2.0 | | | |
| Wingate Quarry | 11.1 | | y | | |
| *Total notified in SSSI* | 181.84 | <56.06 | | | |
| Easington pSSSI site (a) | | | y | | y |
| Easington pSSSI site (b) | 1.04 | 1.04 | | | |
| Sunderland pSSSI site | 2.57 | 0.22 | | 0.01 | 2.34 |
| Durham pSSSI site | 1.66 | 0.58 | | | |
| *Total within potential SSSI* | 5.27 | 1.84 | | | |
| *Grand total* | 187.11 | <57.9 | | | |

Notes.

Data in column 2 mostly from Dalby (1991). Other data from English Nature sources.

Grassland at Hawthorn Dene has been listed as Magnesian Limestone grassland in the past, but this is not strictly the case.

**FIGURE 5**

The distribution of Magnesian Limestone grassland within the DMLNA. Significant (ie designated) sites only are shown, although very little of this habitat exists outside of such sites.

red sites are SSSI
green sites are CWS
**P** denotes sites with mostly primary grassland
small sites are denoted by a spot.

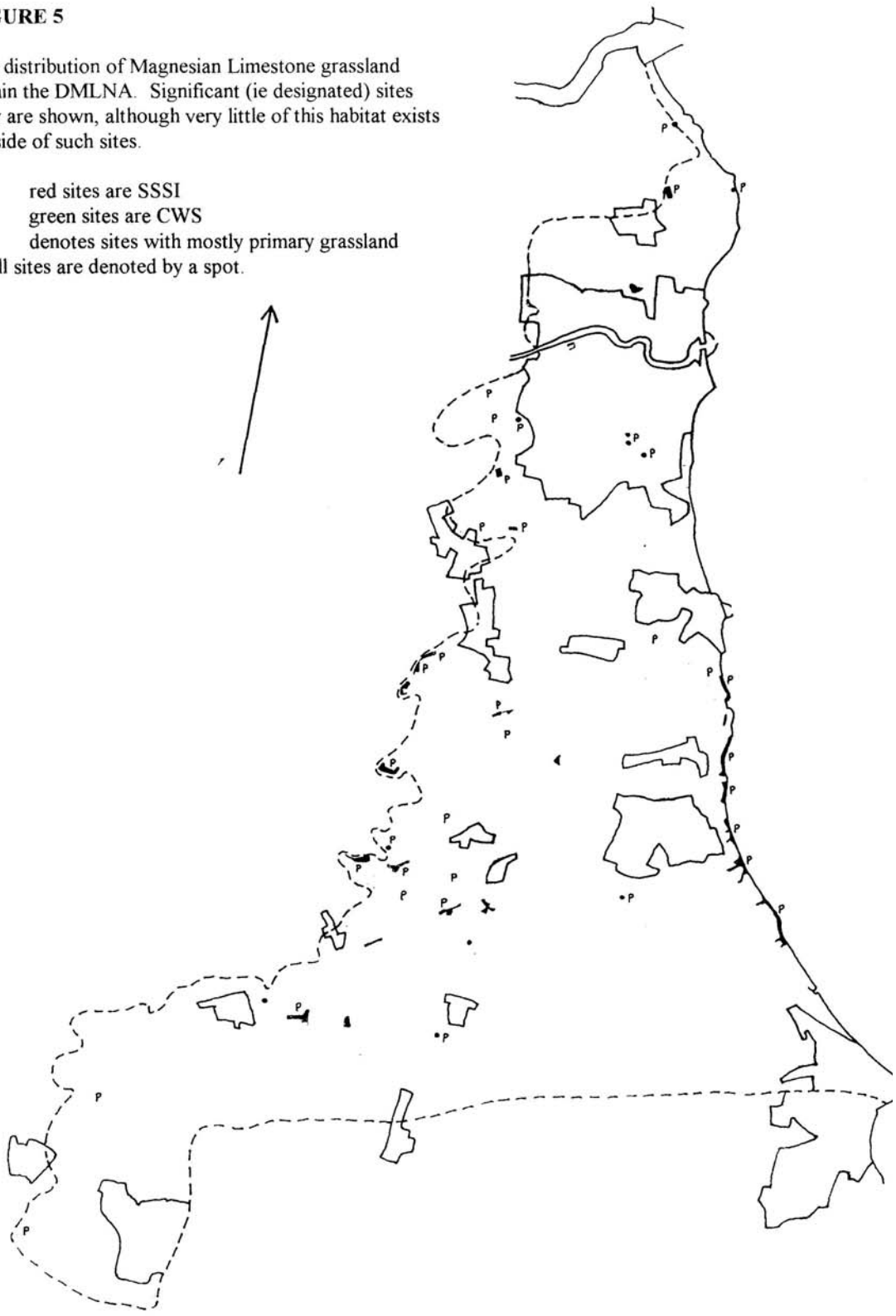
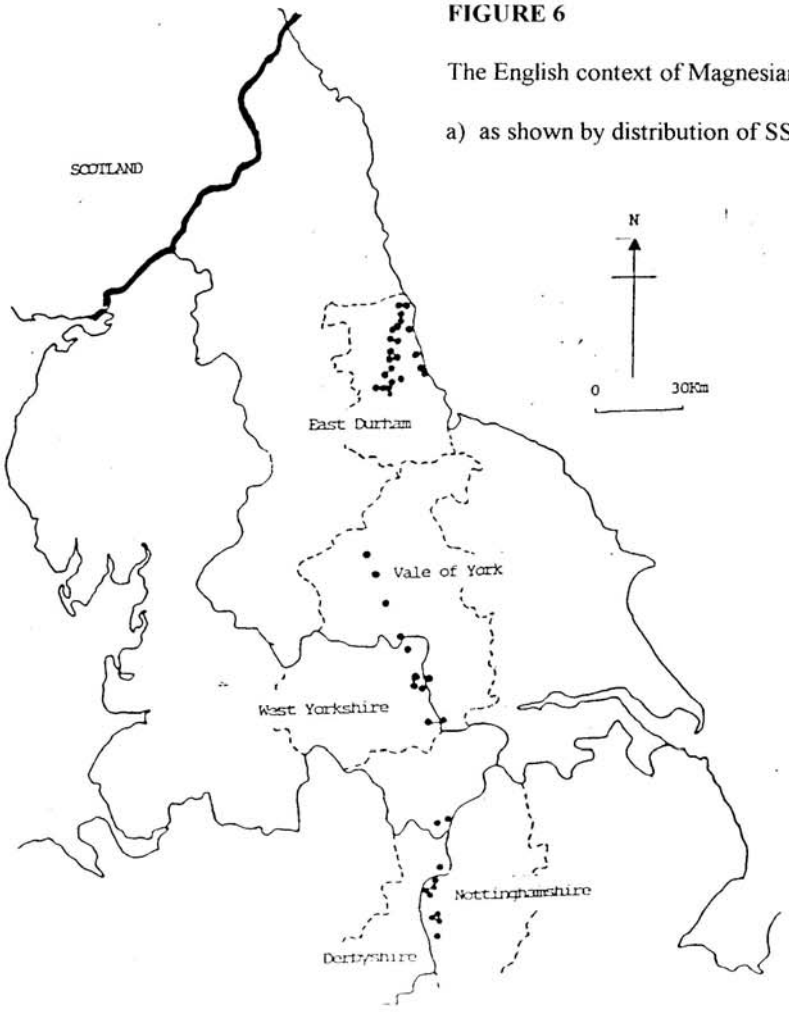


**FIGURE 6**

The English context of Magnesian Limestone grassland interest

a) as shown by distribution of SSSIs notified for this type




b) as shown by area of this type, by English Nature's Areas of Search

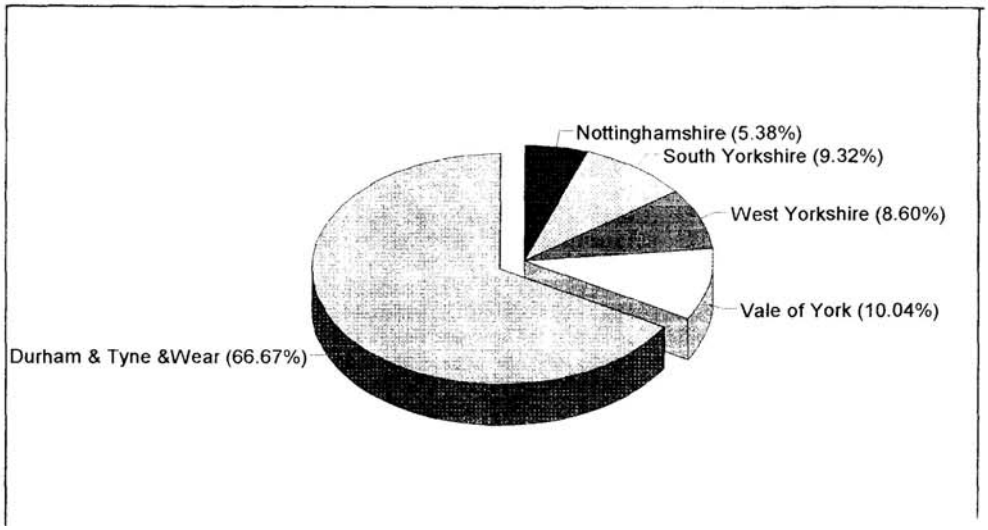


**FIGURE 7**

The distribution of unimproved neutral and acid grassland and heath within the DMLNA. Significant (ie designated) sites only are shown, although very little of this habitat exists outside of such sites.

red sites are SSSI
green sites are CWS
all sites are unimproved neutral grassland unless initialled
**AG** denotes acid grassland
**PH** denotes primary heathland
**SH** denotes secondary heathland
small sites are denoted by a spot.

**FIGURE 8**

The distribution of woodland within the DMLNA. Significant (ie designated) sites only are shown; very little ancient woodland exists outside of such sites.

red sites are SSSI; most are ancient
bright green sites are ancient woodland CWS
pale green sites are other woodland CWS
**A** denotes an acidic woodland
small sites are denoted by a spot.

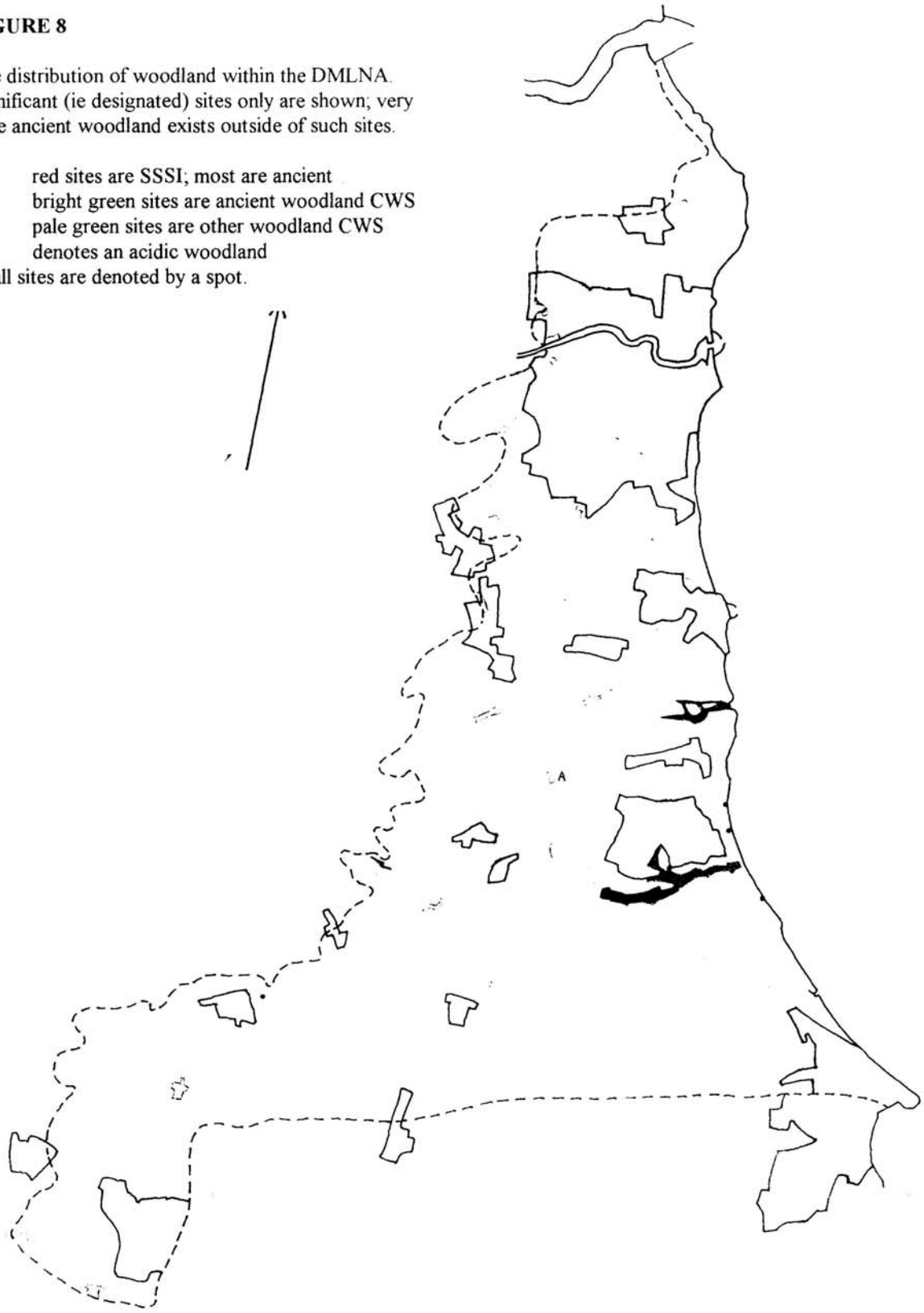
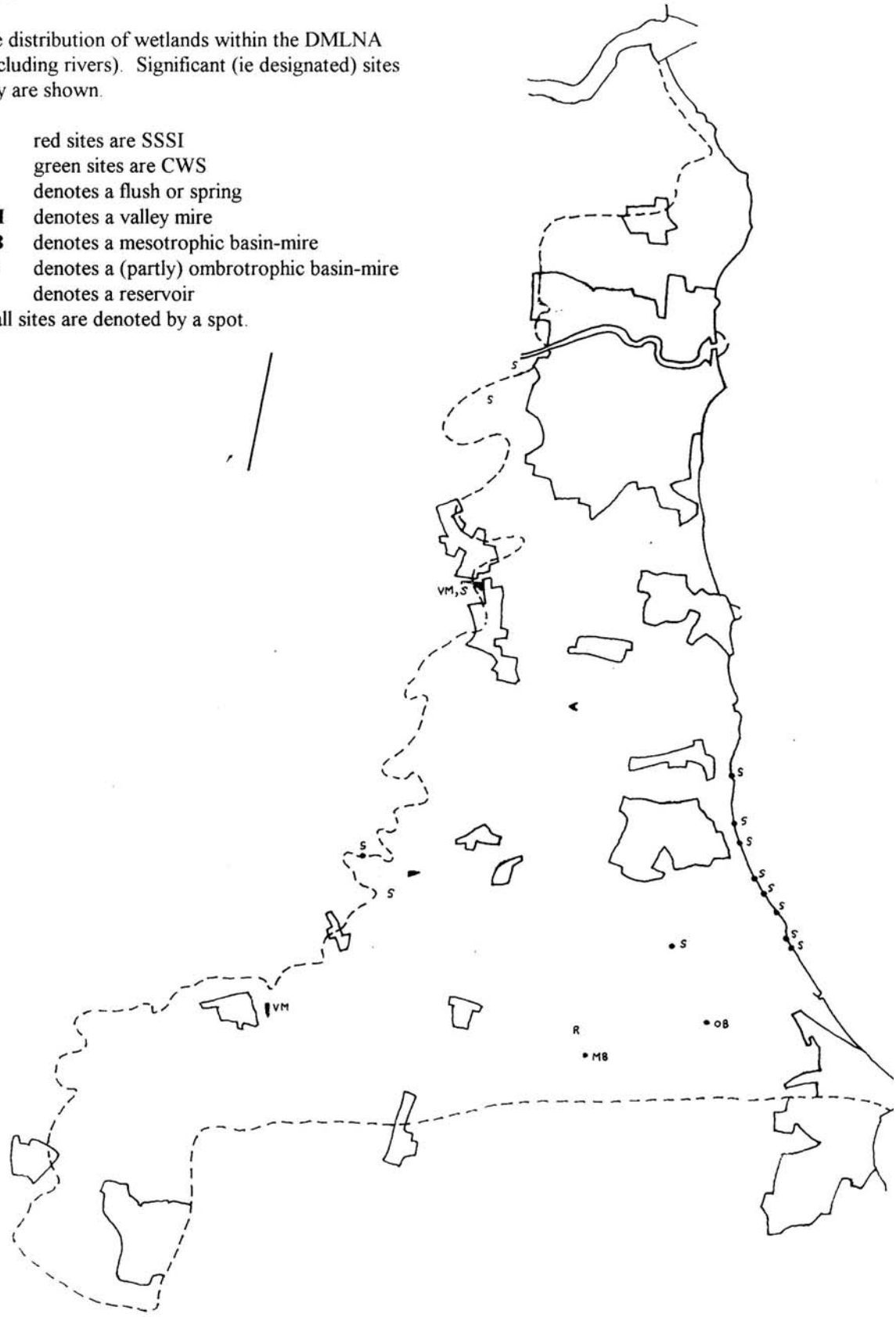


**FIGURE 9**

The distribution of wetlands within the DMLNA (excluding rivers). Significant (ie designated) sites only are shown.

red sites are SSSI
green sites are CWS
**S** denotes a flush or spring
**VM** denotes a valley mire
**MB** denotes a mesotrophic basin-mire
**OB** denotes a (partly) ombrotrophic basin-mire
**R** denotes a reservoir
small sites are denoted by a spot.



## 2.2 Species

### 2.2.1 General note

In recent years a bewildering array of terminology has arisen in order to focus attention on the conservation of species. Effort has been made to ensure that the most threatened species (not always the rarest) are covered by protective legislation; this may be domestic in origin (*scheduled species*) or, latterly, European (species protected by the *Habitats and Species Directive*). In parallel, non-statutory notations have arisen in order to categorise the degree of rarity or threat faced by species, in an effort to target action. These include the *Red Data Books* (which generally include the scheduled species and have recently been revised) and a "lower" tier, *Nationally Scarce* and *Nationally Notable Species*, which are nevertheless usually still of considerable conservation concern. The *UK Biodiversity Action Plan*, agreed by Government in May 1996, has taken a broad approach to targeting, incorporating not just those rarer organisms covered by any of the above systems, but species still common, such as the Song Thrush, which nevertheless show alarming rates of decline. Recognising decline at this stage is a new an important development in conservation and should be welcomed.

Because all of these terms have a national perspective, they do not always fully address species of local concern, such as those which may be rare and/or characteristic of the Natural Area. This document therefore also recognises Natural Area *key species* in some instances, where these are important in conferring local 'flavour', but are not covered by any of the above terms.

### 2.2.2 Flora

The Natural Area supports a diversity of plant communities as discussed in previous chapters. Individual species of importance tend to be restricted to the magnesian limestone grasslands, ancient woodlands and the coast.

The suite of vascular plants, in particular, forms a very valuable component of the Natural Area. This is because they define its local character better than almost any other feature. This in turn is due to the fact that they are very well-studied (unlike most of the invertebrate fauna), there are a large number of them, and they contain a mix of upland and southern species which is almost unique amongst the Natural Areas of Britain. Maintaining the full range of this suite of plants, which gives the area its 'flavour', must be a high priority for the DMLNA. Unfortunately, as can be seen on Table 2, a large number of these species are already endangered, critically endangered, or even extinct. As a consequence, the quality of the overall habitat resource (largely grassland) must be regarded as seriously and continuingly impoverished.

A large number of nationally scarce vascular plants have been recorded. Especially characteristic of the Natural Area are Dark-red Helleborine *Epipactis atrorubens*, and Bird's-eye Primrose *Primula farinosa.* The suite of key species is extremely important, despite not being recognised nationally as priorities for conservation. Only those key species which are of conservation concern due to their decline or vulnerable populations are shown on Table 2, but most of these are individually more common or even abundant elsewhere in the country. Globeflower, for example, is very locally abundant in some of the Pennine Dales, but now persists as a tiny handful of populations in the lowlands, two or three of which persist in the

DMLNA, one of which holds only 1-2 plants. It was once a widespread but scarce plant of the DMLNA where it - a northern montane species - rubbed shoulders with predominantly southern plants in a unique way. Likewise Dropwort, much more at home on the dry hills of Salisbury Plain, just manages - or managed - to survive in the harsher climate of east Durham where it looks strange growing with Blue Moor-grass. Decades of habitat loss, then management neglect, have resulted in these tiny vulnerable populations. It is likely that a combination of their consequent genetic impoverishment and climate changes (especially low rainfall) may now be finishing them off.

There are just three species in the higher category of rarity (nationally-rare species) located within the DMLNA: the leafy-liverwort *Lophozia perssonnii*, the Jelly-lichen *Collema bachmanianum,* and the Lady's Slipper *Cypripedium calceolus,* which appears on Schedule 8 of the Wildlife & Countryside Act (1981), and which formerly occurred in the DMLNA in two woodland denes. This latter species was almost collected to extinction in Britain, but has now been the subject of concerted action for reintroduction elsewhere. A great number of other species characteristic of the area have also been lost from the DMLNA this century, such as green-winged orchid *Orchis morio,* Sword-leaved helleborine *Cephalanthera longifolia* and a whole group of arable "weeds", another feature linking the DMLNA to the south.

### 2.2.3 Fauna

#### 2.2.3.1 Invertebrates

When compared to the wealth of information on the botanical interest of the DMLNA, knowledge of the invertebrates is substantially more limited. However, they do represent the most significant faunal interest within it (Dunn & Sheppard, 1980). Of particular importance are Lepidoptera which have been extensively studied - the most notable species being the Durham Argus *Aricia artaxerxes ssp. salmacis,* a subspecies endemic to northern Britain and well represented in the DMLNA. A wide range of vegetation types exist within the formation, supporting a diverse number of associated species. In general, the calcicolous grasslands are the main habitat of interest, supporting a number of Lepidoptera directly associated with the Natural Area (Dalby, 1991). Only recently has the invertebrate interest been summarised in the Invertebrate Site Register (ISR), held by the Joint Nature Conservation Committee (JNCC).

The ISR details the conservation status of invertebrates, assessed according to the standard criteria (NCC, 1989). Nationally rare species (occurring in 1-15 10km squares of the national grid) are listed in the British Red Data Book (Shirt, 1987; JNCC, 1991). Nationally-notable species (occuring in 16-100 10km squares) can be subdivided into Notable A (Na) species (16-30 10km squares) and Notable B (Nb) species (31-100 10km squares).

The ISR states that Castle Eden Dene National Nature Reserve is a site of national importance for invertebrate conservation, equivalent to NCR status on the grounds of invertebrate interest. In addition, over one quarter of the sites are known to be regionally important for invertebrates. Around one quarter of the sites were thought to be of similar importance but had not been sufficiently surveyed for this to be conclusive. Approaching one third of magnesian limestone grassland sites are unrecorded in the ISR (Dalby, 1991).

**Lepidoptera**

The Durham Argus butterfly *(Aricia artaxerxes ssp. salmacis)* is both a scarce subspecies and the most notable occurring on the Durham magnesian limestone grasslands. Furthermore it has suffered both a national and local decline (Cook, 1990; Ellis, 1993). Most colonies are small and isolated and until recently very little was known about the ecological requirements of the species in the wild (Ellis, 1993). The Durham Argus is protected under Schedule 5 of the 1981 Wildlife and Countryside Act and is listed as a Red Data Book Notable B category species.

The distribution of the Durham Argus is primarily determined by the presence of its larval foodplant the common rockrose *Helianthemum nummularium,* which is only found on limestone grassland or grassland with a basic substrate. In Durham, abandoned magnesian limestone quarries have become ideal habitats and many of them are able to support Argus colonies. The Argus is present at twenty-three small and isolated coastal colonies between Dawdon and Hartlepool and fifteen small inland colonies on ancient limestone pasture, such as Cassop Vale, Sherburn Hill, Town Kelloe Banks and Thrislington (Ellis, 1993).

The nationally-notable Cistus Forester *Adscita geryon*, a small bright green moth which flies during the daytime also requires rockrose and is therefore associated with the magnesian limestone grassland. Its colonies appear to have become more restricted in recent years so that it is now found only on the coast and at one inland site.

One species of the magnesian limestone woodlands is the nationally-notable Blomer's Rivulet *Discoloxia blomeri*, which was first discovered in Britain at Castle Eden Dene. Its larva feeds on wych elm *Ulmus glabra*, whilst the adult is found on leaves and tree trunks. Other moths characteristic of the coastal denes are the Lilac Beauty *Apeira syringeria* and Green Arches *Anaplectoides prosina*.

The grassland in the cliff hollows, between Castle Eden Dene and Hart Golf Course has long been popular with entomologists and it is here that other calcareous grassland species such as the Least Minor *Photedes captiuncula*, Chalk Carpet *Scotopteryx bipunctaria*, Plain Wave *Idaea straminata*, Annulet *Gnophos obscuratus*, Sharp-angled Carpet *Euphyia unangulata* and the tiny Plume Moth *Pterophorus tridactyla* occur.

The White Letter Hairstreak *Strymonidia w-album* is also nationally-notable and is generally regarded as an uncommon southern butterfly. It occurs at Castle Eden Dene (which is thought to be its most northern locality in Britain) and has also been recorded from Thrislington.

The quarries and some of the sheltered hollows on the coastal cliffs also provide suitable habitats for a number of common butterflies, such as the Common Blue *Polyommatus icarus*, Dingy Skipper *Erynnis tages*, Orange Tip *Anthocharis cardamines*, Wall Brown *Lasiommata megera* and Meadow Brown *Maniola jurtina*. A total of 18 species have recently been recorded on the magnesian limestone grasslands of the area (Cook, 1990; Ellis, 1991).

**Other invertebrates**

With the exception of Castle Eden Dene, information on invertebrates other than Lepidoptera

is limited. Castle Eden Dene has been a centre of entomological interest since the early 1970's and most groups have been examined resulting in an extensive species list numbering almost 300 notable species (Ball, 1986). Excluding historical records, 7 nationally rare and 58 nationally scarce species occur at Castle Eden Dene alone, along with a long list of regionally and locally significant species.

Several Red Data Book beetles occur on the magnesian limestone. The beetle *Stenus fossulatus* occurs at Castle Eden Dene. Generally found in wet mud, clay or sand, it favours limey soil, often on earthslips of calcareous clay in open areas with a sparse growth of herbs. Diptera have also been well recorded with 5 nationally rare species present in the DMLNA. Also of note are glow-worms *Lampyris noctiluca* recorded at Thrislington.

Table 3 provides a list of nationally significant invertebrates.

### 2.2.3.2 Birds

As the DMLNA is dominated by pasture and arable farmland, it is generally limited in terms of ornithological interest (Grice *and others.* 1994). However, a number of important birds do occur within the Natural Area as widespread or localised breeding residents. Table 4 summarises the ornithological information for the Natural Area.

Agricultural habitats within the Area can support a number of breeding bird species of conservation interest. The Grey Partridge *Perdix perdix* in particular is perhaps one of the most important and characteristic birds of the Natural Area, being a widespread and common resident throughout the county of Durham as a whole (Armstrong, 1992). Agricultural intensification has led to the national decline of this species and the plight of the grey partridge is highlighted, amongst other sources, by the Red Data book (Batten *and others.*, 1990), Brown & Grice (1993) and the UK Biodiversity Action Plan, which lists it on the short list. Farmland in the Natural Area can also support a number of important species which breed at low densities, for example, barn owl, corn bunting, lapwing and skylark**.** All four of the these species have suffered a national decline and the latter three are all currently listed as candidate Red Data species (Batten *and others*, 1990). Farmland in the DMLNA supports good numbers of the more ubiquitous bird species, especially seed-eating passerines, and wintering species such as fieldfare and redwing. Many farmland species appear to be important indicators of environmental change (Marchant *and others*. 1990).

Although wetland habitats are scarce in the DMLNA, small breeding populations of waterfowl do occur, predominantly on man-made wetlands. One of the most important sites on the magnesian limestone is Hurworth Burn Reservoir, which holds large numbers of breeding and wintering wildfowl and 35 species of waders have been recorded (Davis, 1980). Of particular interest are the Red Data species garganey, pintail and pochard, which are not only rare breeders within the Natural Area but also in Britain as a whole.

The semi-natural woodland denes of the coastal edge of the Natural Area are of local interest, supporting a characteristic woodland bird community of spring migrants and common residents, including the still common but much declined Song Thrush, another species listed on the short list of the UK Biodiversity Action Plan. Woodland birds typical of western Durham, such as redstart, grey wagtail and nuthatch, are found within these eastern woodlands in good numbers.

The coastline is also of regional importance for its breeding seabird colony. Marsden Rock, a large magnesian limestone sea stack along the Trow Point section, is recognised as the most important mainland seabird colony between the Farne Islands and Bempton Cliffs in Yorkshire (Davis, 1980). It supports nationally important numbers of cormorant and kittiwake and lesser numbers of gulls, fulmar and razorbill. Wintering sanderling regularly reach nationally significant numbers and commonly occur with purple sandpipers and turnstone.

### 2.2.3.3 Mammals

#### Bats

All 14 species of bat known to occur regularly in Britain are afforded special protection under Schedule 5 of the 1981 Wildlife and Countryside Act as amended. All bat species are also listed in Annex IV of the EC Habitats and Species Directive (EC, 1992). The DMLNA has a low bat species diversity with just 2 species commonly recorded (Hinchcliffe, 1994). However, both these species are vulnerable and declining nationally (Morris, 1993) and these local populations can nonetheless be regarded as regionally important.

Since 1983, the only commonly encountered species over the area has been the Pipistrelle *Pipistrellus pipistrellus*, a species accorded high priority by the UK Biodiversity Action Plan. Summer roost sites of this species are scattered but mainly occur along the western part of the DMLNA. Significant pipistrelle nursery colonies (>100 individuals) are known from Sunderland, Penshaw, Hutton Henry, Kirk Merrington and Aycliffe. The only species other than the pipistrelle recorded from coastal areas is the Noctule *Nyctalus noctula*. This bat has been reported from several of the woodland denes with a confirmed summer roost at Castle Eden Dene. Noctules have also been recorded from Kirk Merrington.

#### Red Squirrel

The exact status of the red squirrel *Sciurus vulgaris* in the DMLNA is unclear, yet its distribution is probably restricted to areas of coastal woodland. A relict population of this animal is present along the coastal fringe at Castle Eden Dene and has been recorded at both Hesledon and Hawthorn Denes. The red squirrel is specially protected under Schedule 5 of the 1981 Wildlife and Countryside Act and has been the subject of major conservation initiatives around the UK on account of its dramatic contraction in range and numbers this century. A woodland mammal, its future within the largely open Natural Area is uncertain.

#### Badger

Information on the badger *Meles meles* in the DMLNA is also sparse yet it seems that this specially protected animal is generally widespread across the area. Although increasing in some areas of the UK, the badger is vulnerable to local population decline through land use changes and illegal persecution.

All of these species listed above are British Red Data mammals (Morris, 1993).

#### Water Vole

A species which is now receiving increased attention owing to its proposed addition to the WCA and its inclusion, as a species of high conservation concern, within the UK Biodiversity Action Plan. Its occurrence within the DMLNA is likely to be of at least local concern.

#### 2.2.3.4 Amphibians

Despite the scarcity of wetland habitats, five species of amphibian have been recorded in the Natural Area, most notably the Great Crested Newt *Triturus cristatus*. This species is listed on Schedule 5 of the 1981 Wildlife and Countryside Act and also merits inclusion in Annex II and IV of the EC Habitats and Species Directive (EC, 1992). The great crested newt has a predominantly eastern and lowland distribution in Durham and Tyne & Wear, where the underlying limestone provides mesotrophic pond conditions that this species prefers. A regional survey of newt sites in 1984 uncovered 46 sites occupied by great crested newt (Green, 1984) of which 55% lie within the DMLNA with a predominance of sites in the districts of Darlington and Easington. The DMLNA is now recognised as of major importance nationally for this species (English Nature 1997).

Other species recorded are the smooth newt *Triturus vulgaris*, palmate newt *T. helveticus*, common frog *Rana temporaria* and toad *Bufo bufo*.

## Table 2 Important Plant Sepceis within the BMLNA

The table shows both nationally-important species, and key NA species where these are of conservation concern

| | Sch8 | RDB | NSc | Key | Rason for key species? | District | Status within DMLNA |
|---|---|---|---|---|---|---|---|
| **Lady's Slipper** (Cypripedium calceolus) | * | * | | * | Highly characteristic of northern limestone | Easington | Formerly at least two populations, now extinct in the wild. Last record 1926 |
| **A liverwort** (Lophozia perssonnii) | | * | | | | Sedgefield | Data-deficient; a single site; is increasing nationally |
| **A lichen** (Collema bachmanianum) | | * | | | | Sunderland | Data-deficient; a single site |
| **Bird's-eye Primrose** (Primula farinose) | | | * | ** | Characteristic component of DMLNA flushes | Eas, Durham Sedge | Endangered. At least 3/13 Flora sites lost, 2 severe decline. Only 2 good popns stable. |
| **Blue Moor-grass** (Sesieria caerulea) | | | * | * | Highly characteristic of northern limestone | W Tyne, sund, Eas, Sedge,Du | Least concern on most sites; actually increasing on some |
| **Burnt-tip Orchid** (Orchis ustulata) | | | * | * | S species reaching northern limit | Hartlepool | Critically endangered, but no recent decline |
| **Dark-red Helleborine** (Epipactis atrorubens) | | | * | ** | Highly characteristic of northern limestone | Sund, Sedge, Durham | Vulnerable. 1/6 recent sites perhaps lost, but 3 sites with good stable populations |
| **Downy Currant** (Ribes spicatum) | | | * | * | Highly characteristic of northern limestone | Easington | Lower risk. A single site in the DMLNA, but other stations in the county |
| **Narrow-leaved Marsh Orchid** (Dactylorhiza traunsteineri) | | | * | | | Easington | Critically endangered. A single small population |
| **Perennial Flax** (Linum perenne ssp anglicum) | | | * | * | S species reaching northern limit; endemic | Sedge, S Tyne, Sunderland | Lower risks. 3 SSSI sites with good populations, plus other sites |
| **Rare Spring-sedge** (Carex ericetorum) | | | * | * | S species reaching northern limit | Sedgefield | Formerly in a single site, but now extinct. Last record 1950 |
| **Round-leaved Wintergreen** (Pyrola rotundifolia) | | | * | | | Easington | Critically endangered, 3 small populations |
| **Spring Cinquefoil** (Potentilla neumanniana) | | | * | | | Hartlepool | Endangered, thought Flora quotes sings of increase |
| **Sword-leaved Helleborine** (Cephalanthera longifolia) | | | * | | | Easington | Formerly in at least 5 populations; extinct in the wild with last record 1868 |
| **Basil-thyme** (Acinos arvensis) | | | | * | S species reaching northern limit | Durham, Sedgefield | Vulnerable; at least one large population, but 2/4 Flora sites lost? |
| **Bee Orchid** (Ophrys apifera) | | | | * | S species reaching northern limit | S Tyne, Sund, Eas, Sedge, Du | Lower risk |
| **Butterwort** (Pinguicula vulgaris) | | | | ** | Characteristic component of DMLNA flushes | Sedge, Durham, Eas, Hartlepool | Endangered. At least a dozen sites but most small and probably declining |
| **Dioecious Sedge** (Carex dioica) | | | | * | Characteristic component of DMLNA flushes | Sedge, Eas, Hartlepool | Critically endangered or extinct in the wild |
| **Dogwood** (Cornus sanguinea) | | | | * | S species reaching northern limit | Eas, Hartlepool, Sund, Durham | Lower risk |
| **Dropwort** (Filipendula vulgaris) | | | | * | S species reaching northern limit | Sedgefield, S tyne, Durham | Data-deficient, but probably critically endangered 3 Flora sites, last seen 1986 |
| **Fly Orchid** | | | | * | S species reaching northern | Easington | Critically endangered. A |

| | Sch8 | RDB | NSc | Key | Rason for key species? | District | Status within DMLNA |
|---|---|---|---|---|---|---|---|
| (Ophrys insectifèra) | | | | | limit | | single site with no recent record, but sp. appears sporadically. |
| **Globeflower** (Trollius europaeus) | | | | * | N species not known from other lowland limestones | Durham, S Tyne, Easington | Critically endangered in the DMLNA; more frequent in the uplands |
| **Grass-of-Parnassus** (Parnassia palustris) | | | | ** | Characteristic component of DMLNA flushes | Easington, Durham, Sedge | Endangered on the coast; perhaps now extinct inland at 3 former sites? |
| **Green-winged Orchid** (Orchis morio) | | | | * | S species not known from other northern limestones | Easington | Formerly in at least one coastal site. Extinct in the wild; last record 1960 |
| **Gromwell** (Lithospermum officinale) | | | | * | S species not known from other northern limestones | Easington | Critically endangered |
| **Juniper** (Juniperus communis) | | | | * | Characteristic limestone shrub | Easington | Critically endangered in spite of recent reintroductions |
| **Lesser Clubmoss** (Selaginella selaginoides) | | | | ** | N species not known from other lowland limestones | Easington, Durham | Critically endangered. Perhaps ¾ Flora sites lost. |
| **Marsh Helleborine** (Epipactis palustris) | | | | * | S species reaching northern limit | Eas, Sedge, Hartlepool | Critically endangered or extinct in the wild |
| **Melancholy Thistle** (Cirsium helenioides) | | | | * | N species not known from | Esington, Durham | Data-deficient. Possibly still at all 4 DMLNA sites. |
| **Mountain Everlasting** (Antennaria dioica) | | | | ** | N species very rare on other lowland limestones | Sedgefield | Critically endangered in DMLNA, where 2/3 Flora sites lost. Frequent in uplands |
| **Pale St John's-wort** (Hypericum montanum) | | | | * | S species reaching northern limit | Easington, Sund, Durham, Sedge | Data-deficient but probably lower risk, as the species copes in unmanaged swards |
| **Purple Milk-vetch** (Astragalus danicus) | | | | * | S species reaching north limit for inland limestones | Easington, Sund, S Tyne | Endangered on 3 remaining sites |
| **Purple Moor-grass** (Molinia caerulea) | | | | * | Extremely unusual and rare in lowland limestone | Easington, Durham | Vulnerable on limestone; other sites occur on drift, however |
| **Sea Plantain** (Plantago maritime) | | | | * | Not known from other lowland limestones inland | S Tyne, Sund, Eas, Sedge, Du. | Lower risk |
| **Sea Spleenwort** (Asplenium marimun) | | | | * | Oceanic maritime species on edge of range | Easington, South Tyneside | Vulnerable, though perhaps no decline. Still at all 4 DMLNA sites |
| **Spurge Laurel** (Daphne laureola) | | | | * | S species reaching northern limit | Easington | Lower Risk |
| **Stone Bramble** (Rubus saxatilis) | | | | * | N species very rare on other lowland limestones | Easington | Endangered at its only DMLNA site. More frequent in the uplands |

Notes

Sch 8 = listed on Schedule 8 of Wildlife & Countryside Act; RDB = a Red Data Book (nationally-rare); NSc = a nationally-scarce species.

A key species is one which contributes strongly to the local character of the habitat in which it grows either because it is rare in or not known from similar habitats elsewhere in Britain, or because it formerly showed some degree of preference for this Natural Area in the past but is only now present in small or threatened populations. Key species coded thus ** are considered especially important.

Other species considered rare in the County Durham but not showing a particular preference for the DMLNA are not listed.

## Table 3: Invertebrates in the DMLNA

| Species | Status | Site |
|---|---|---|
| **Coleoptera (beetles)** | | |
| *Helophorus dorsalis* | Nationally Notable | Blackhall Cliffs |
| *Agabus unguicularis* | Nationally scarce (Nb) | Heselden Moor West |
| *Pterostichus cristatus* | Nationally scarce (Nb) | Trimdon Grange Quarry |
| *Cercyon tristis* | Nationally scarce (Nb) | Wingate Quarry |
| *Hydroporus ferrugieus* | Nationally scarce (Nb) | Hawthorn Dene |
| *Pterostichus cristatus* | Nationally scarce (Nb) | Cassop Vale, Hawthorn Dene<br>Town Kelloe Banks, Raisby Grassland |
| *Stenus fossulatus* | Nationally rare RDB1 | Castle Eden Dene |
| *Apthana nigriceps* | Nationally scarce (Nb) | Castle Eden Dene |
| *Colon latum* | Nationally notable | Castle Eden Dene |
| *Epurea angustula* | Nationally scarce (Nb) | Castle Eden Dene |
| *Leiodes rugosa* | Nationally scarce (Nb) | Castle Eden Dene |
| *Longitarsus suturalis* | Nationally scarce (Nb) | Castle Eden Dene |
| *Agabus biguttatus* | Nationally scarce (Nb) | Castle Eden Dene |
| *Agabus conspersus* | Nationally scarce (Nb) | Castle Eden Dene |
| *Aleochara ruficornis* | Nationally scarce (Nb) | Castle Eden Dene |
| *Atheta hygrobia* | Nationally scarce (Nb) | Castle Eden Dene |
| *Bembidion laterale* | Nationally scarce (Nb) | Castle Eden Dene |
| *Bembidion stomoides* | Nationally scarce (Nb) | Castle Eden Dene |
| *Brachysomus echinatus* | Nationally scarce (Nb) | Castle Eden Dene |
| *Dropephylla gracilicornis* | Nationally scarce (Nb) | Castle Eden Dene |
| *Epuraea longula* | Nationally scarce (Nb) | Castle Eden Dene |
| *Grypus equiseti* | Nationally scarce (Nb) | Castle Eden Dene |
| *Helophorus griseus* | Nationally scarce (Nb) | Castle Eden Dene |
| *Ilybius subaeneus* | Nationally scarce (Nb) | Castle Eden Dene |
| *Lathrobium ripicola* | Nationally scarce (Nb) | Castle Eden Dene |
| *Licinus depressus* | Nationally scarce (Nb) | Castle Eden Dene |
| *Limnebius nitidus* | Nationally scarce (Nb) | Castle Eden Dene |
| *Magdalis carbonaria* | Nationally scarce (Nb) | Castle Eden Dene |
| *Mantura rustica* | Nationally scarce (Nb) | Castle Eden Dene |
| *Ochthebius bicolon* | Nationally scarce (Nb) | Castle Eden Dene |
| *Orthochaetes setiger* | Nationally scarce (Nb) | Castle Eden Dene |
| *Oxypoda exoleta* | Nationally scarce (Nb) | Castle Eden Dene |
| *Rabocerus gabrieli* | Nationally scarce (Nb) | Castle Eden Dene |
| *Sitona macularius* | Nationally scarce (Nb) | Castle Eden Dene |
| *Trechus rubens* | Nationally scarce (Nb) | Castle Eden Dene |
| *Rantus suturalis* | Nationally scarce (Nb) | Hawthorn Dene |
| ***Diptera (flies)*** | | |
| *Platycheirus perpallidus* | Nationally scarce (Nb) | The Carrs |
| *Didea fasciata* | Nationally scarce (Nb) | Heselden Dene |
| *Coenosia stagmatica* | Nationally rare RDB3 | Hawthorn Dene |
| *Colobaea bifasciella* | Nationally notable | Hawthorn Dene |
| *Pherbellia grisescens* | National notable | Hawthorn Dene |
| *Stratiomys potamida* | Nationally notable | Raisby Grassland, Wingate Quarry |
| *Themira nigricornis* | Nationally rare RDB3 | Wingate Quarry |
| *Agryra atriceps* | Nationally scarce (Nb) | Hawthorn Dene |

| Species | Status | Site |
|---|---|---|
| *Limonia trivittata* | Nationally scarce (Nb) | Hawthorn Dene |
| *Oxycera pygmaea* | Nationally scarce (Nb) | Seaham Bay |
| *Phaonia falleni Michelsen* | Nationally scarce (Nb) | Wingate Quarry |
| *Phaonia zugmayeriae* | Nationally scarce (Nb) | Hawthorn Dene |
| *Platypalpus cothurnatus* | Nationally scarce (Nb) | Bishop Middleham Quarry |
| *Ptiolina atra* | Nationally scarce (Nb) | Hawthorn Dene |
| *Ptiolina obscura* | Nationally scarce (Nb) | Hawthorn Dene |
| *Tetanocera punctifrons* | Nationally scarce (Nb) | Blackhall Cliffs, Seaham Bay |
| *Hilera setosa* | Nationally rare RDB2 | Castle Eden Dene |
| *Platypalpus mikii* | Nationally rare RDB3 | Castle Eden Dene |
| *Dexiopsis minutalis* | Nationally notable | Castle Eden Dene |
| *Trichocera maculipennis* | Nationally notable | Castle Eden Dene |
| *Tipula nubeculosa* | Nationally rare pRDB3 | Castle Eden Dene |
| *Beris clavipes* | Nationally scarce (Nb) | Castle Eden Dene |
| *Caricea spuria* | Nationally scarce (Nb) | Castle Eden Dene |
| *Dicranata guerini* | Nationally scarce (Nb) | Castle Eden Dene |
| *Didea fasciata* | Nationally scarce (Nb) | Castle Eden Dene |
| *Eudorylas jenkinsoni* | Nationally scarce (Nb) | Castle Eden Dene |
| *Hydrotaea pilipes* | Nationally scarce (Nb) | Castle Eden Dene |
| *Hypophyllus disciples* | Nationally scarce (Nb) | Castle Eden Dene |
| *Limonia trivittata* | Nationally scarce (Nb) | Castle Eden Dene |
| *Micromorphus albipes* | Nationally scarce (Nb) | Castle Eden Dene |
| *Molophilus varisipinus* | Nationally scarce (Nb) | Castle Eden Dene |
| *Oedalea zetterstedti* | Nationally scarce (Nb) | Castle Eden Dene |
| *Paragus tibialis* | Nationally scarce (Nb) | Castle Eden Dene |
| *Phaonia zugmayeriae* | Nationally scarce (Nb) | Castle Eden Dene |
| *Spania nigra* | Nationally scarce (Nb) | Castle Eden Dene |
| *Sphegina verecunda* | Nationally scarce (Nb) | Castle Eden Dene |
| *Tetanocera phyllophera* | Nationally scarce (Nb) | Castle Eden Dene |
| *Tipula pseudovariipennis* | Nationally scarce (Nb) | Castle Eden Dene |
| *Xylota florum* | Nationally scarce (Nb) | Castle Eden Dene |
| *Xylota tarda* | Nationally scarce (Nb) | Castle Eden Dene |
| **Araneae** | | |
| *Tapinocyboides pygmaea* | Nationally rare RDB3 | Town Kelloe Banks |
| **Mollusca (molluscs)** | | |
| *Clausilia dudia* | Nationally scarce (Nb) | Hawthorn Dene, Tunstall Hills and Ryhope Cutting |
| **Opiliones (harvestmen*)*** | | |
| *Opilio saxatilis* | Nationally notable | Tunstall Hills and Ryhope Cutting |
| **Lepidoptera (butterflies and moths)** | | |
| **Butterflies** | | |
| *Strymonidia w-album* | Nationally scarce (Nb) | Castle Eden Dene |
| *Aricia artaxerxes ssp salmacis* | Nationally scarce (Nb) | Thrislington, Durham Coast & 11 inland sites |
| **Moths** | | |
| *Epiblema grandaevana* | Nationally rare pRDB1 | Castle Eden Dene |
| *Aphelia unitana* | Nationally rare pRDB2 | Bishop Middleham Quarry |
| *Photedes captiuncula (least minor)* | Nationally rare RDB3 | Blackhall Cliffs, Cassop Vale Seaham Bay, Thrislington |

| Species | Status | Site |
|---|---|---|
| *Adscita geryon* | Nationally scarce (Nb) | Blackhall Cliffs |
| *Adscita statices (the forester)* | Nationally scarce (Nb) | Sherburn Hill |
| *Aethes piercei* | Nationally scarce (Nb) | Hawthorn Dene |
| *Discoloxia blomeri (blomer's rivulet)* | Nationally scarce (Nb) | Castle Eden Dene, Heselden Dene |
| *Perizoma minorata (heath rivulet)* | Nationally scarce (Nb) | Seaham Bay |
| *Platyptilia ochrodactyla* | Nationally scarce (Nb) | Wingate Quarry |
| *Scotopteryx bipunctaria (chalk carpet)* | Nationally scarce (Nb) | Hawthorn Dene, Seaham Bay, Wingate Quarry |
| **Hymenoptera** | | |
| *Andrena ruficrus* | Nationally rare RDB3 | Castle Eden Dene |

List revised to include 1994 category changes
(Sheppard, 1994, pers. comm.)

Excludes historical records

**Table 4**

| Natural Area 5:<br>Durham Magnesium Limestone | Ornithological<br>Significance Some |
|---|---|

**General ornithological character**: A natural area dominated by pasture and arable farmland and is generally of limited ornithological interest. Man-made wetlands and step-sided wooded river valleys provide the main bird habitats. There are small numbers of breeding waders and wildfowl, including the occasional pair of Pintail and Garganey, two rare breeding birds.

| | | |
|---|---|---|
| Internationally important species | | |
| English Nature high priority | List 1 | List 2<br><br>Grey Partridge |
| Other notable species | Breeding Redshank, Little Ringed Plover, Snipe, Kingfisher, Yellow Wagtail, Whinchat, Corn Bunting. (Very Small numbers of breeding Oystercatcher, Pochard and Shelduck). | |
| 'Core Area' species | | |
| Extinct/very rare breeding species | Garganey, Pintail, Quail, Barn Owl, Pochard, Osprey. | |
| Key bird habitats | Man-made wetlands, farmland, semi-natural woods. | |
| Species specific action | Opportunistic species protection measures for occasional breeders. | |
| Additional monitoring required | | |

Key issues:

- Lack of management of remaining semi-natural habitats and man-made wetlands
- Opportunities for habitat creation on farmland.
- Recreational disturbance on man-made waterbodies.

## 2.3 Earth Science

The DMLNA possesses considerable geological interest. The Permian Magnesian Limestone sequence described in 1.3 represents a highly significant chapter in the evolution of the British Isles and can be seen at its finest localities in Britain within the Natural Area. Therefore, as its name implies, the DMLNA can justifiably claim to be the type area for the Magnesian Limestone in Britain (Pettigrew, 1980). In addition to the purely geological importance of the Permian Magnesian Limestone sites, the DMLNA also contains sites representing other areas of earth science interest, notably palaeontology, geomorphology and the Quaternary.

The key earth science feature of the DMLNA is thus the stratigraphical interest exposed in the Magnesian Limestone plateau. The most important of these sites have been identified by the Geological Conservation Review (GCR) as being of national importance (Smith, 1994). Seventeen of the 22 GCR sites in the DMLNA are Marine Permian sites (see Table 5), representing two-thirds of all the GCR sites of this type nationally. The GCR sites within the DMLNA collectively cover the whole local marine sequence and all of the major formations described earlier in 1.3.1. All will have been notified as SSSIs by late 1997. The majority of these are either coastal exposures or inland quarries and cuttings. Several of the GCR sites are without parallel in the UK and Western Europe and are considered to be of international importance, ie Blackhall Rocks, Claxheugh Rock and Ford Quarry, Fulwell Hills Quarry and the coastal cliffs of Trow Point to Whitburn Steel (Smith, 1994). Many of the SSSIs in the Natural Area are type localities and lend their name to established stratigraphical nomenclature for the Upper Permian sequence. These include Ford Quarry (Ford Formation), Seaham Harbour (Seaham Formation) and Raisby Hill Quarry (Raisby Formation).

The limestone is also of great interest for its range of Permian marine fauna associated with the Middle Magnesian Limestones, particularly within the remains of the Zechstein sub-marine reef which is considered to be unique in Britain. Key sites for marine fossils are Tunstall Hills, Humbledon Hill and particularly Middridge Quarry which is the most important locality in Britain for Permian fossil reptiles and plants.

Coastal geomorphological processes and landforms are also well represented along the Tyne & Wear coastline from Trow Point to Whitburn Bay and as yet un-notified sites important for demonstrating Pleistocene and Quaternary deposits also occur further south along the coast.

Lastly, small sections of the underlying Carboniferous Coal Measures are exposed along the Wear River Bank at Sunderland. This section exhibits the best exposure of the Carboniferous Permian interface in the region, as the upper Carboniferous strata and the basal layer of the Magnesian Limestone (Yellow Permian Sands) are represented together. Clearly, coal-mining has been a major factor in shaping the landscape and character of the DMLNA to a much greater extent than this single small exposure suggests. However, coal-bearing strata lying beneath the limestone are generally outside the scope of this Natural Area, except insofar as they have influenced (indirectly but sometimes considerably) the nature conservation resource.

These nationally important sites are complemented by approximately 20 County Geological Sites which are locally significant in terms of earth science conservation.

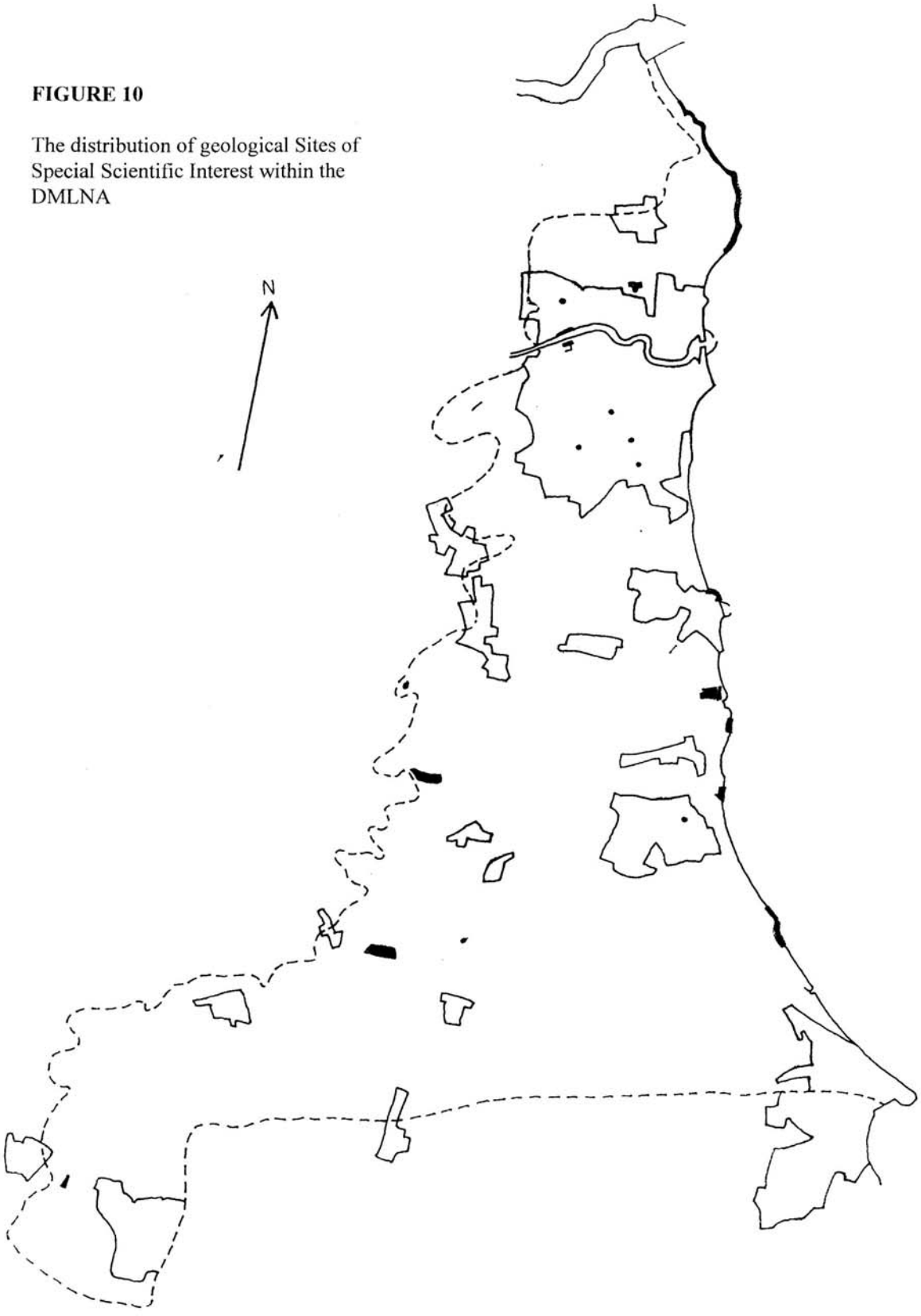
**TABLE 5**
Earth Science SSSI and pSSSI in the DMLNA, showing subject blocks

| | Stratigraphy | | | Palaeontology | | | |
|---|---|---|---|---|---|---|---|
| | Westphalian (Carboniferous) | Marine Permian | Permian - Triassic | Fossil Plants | Fossil Reptiles | Pleistocene/ Quaternary | Coastal Geomorphology |
| Wear River Bank | | | | | | | |
| Trow Point to Whitburn Bay | | | | | | | |
| Fulwell Hills Quarries | | | | | | | |
| Hylton Castle Cutting | | | | | | | |
| Claxheugh Rock, Cutting & Ford Quarry | | | | | | | |
| Dawson's Plantation Quarry | | | | | | | |
| Humbledon Hill Quarry | | | | | | | |
| Tunstall Hills (North) | | | | | | | |
| Tunstall Hills (South) & Ryhope Cutting | | | | | | | |
| Gilleylaw Quarry | | | | | | | |
| Seaham Harbour | | | | | | | |
| Stony Cut, Cold Hesledon | | | | | | | |
| High Moorsley Quarry | | | | | | | |
| Hawthorn Quarry | | | | | | | |
| Horden Quarry (Yoden Village Quarry) | | | | | | | |
| Blackhall Rocks (Durham Coast) | | P | | | | | |
| Shippersea Bay (Durham Coast) | | | | | | P | |
| Warren House Gill (Durham Coast) | | | | | | P | |
| Trimdon Quarry | | | | | | | |
| Raisby Hill Quarry | | | | | | | |
| Crime Rigg & Sherburn Hill Quarries | | | | | | | |
| Middridge Quarry | | | | | | | |

P = SSSI proposed for notification 1997-98. All other sites are SSSI

**FIGURE 10**

The distribution of geological Sites of Special Scientific Interest within the DMLNA



# 3. Issues that Influence the Nature Conservation Resource

## 3.1 Past Management and Vegetation History

Until the arrival of humans on the magnesian limestone plateau, climatic change was probably the most important factor in determining the vegetation of the natural area. This is supported by evidence from pollen analysis taken from a number of sites that roughly correspond to the distribution of magnesian limestone. From the Mesolithic period onwards, people began to settle in the area and use the land for agricultural purposes. Management became the dominant influence on the vegetation as settlements grew and activities diversified.

### 3.1.1 Prehistoric and Historic Times

Evidence from attempts at pollen analysis early this century suggests that in the early Pleistocene or late Pliocene, about 13000 years ago, the magnesian limestone (then some 400-500 ft above sea level) had deep wooded valleys with open areas carrying herbaceous vegetation. Much of this vegetation is now either exotic or extinct and seems to have been remnants of an earlier flora, gradually dying out in Europe with the cooling of the planet and subsequent ice ages.

During the Ipswichian interglacial, temperate forest dominated the landscape, consisting of oak, alder and hazel with pine and birch. This was to be replaced by one dominated by alder and hornbeam, eventually giving way to birch dominated as the climate deteriorated with the onset of the Devensian glaciation.

As the climate warmed in the late Devensian, about 8800 BC-10000 BC, the vegetation appeared to be mainly herbaceous. Juniper was widespread together with grasses and sedges. Other species included rockrose and crowberry.

About 10,000 years ago this late-glacial vegetation gave way to a forested landscape. For about 1000 years various trees succeeded each other in the forests until a relatively stable mixture of elm, oak and hazel with birch and pine had established itself. This lasted throughout the boreal period 5000 BC-8000 BC. At the end of this period, as the result of the wetter Atlantic climate, alder colonized the wetter soils and valley bottoms with oak and elm increasing at the expense of pine.

About 3000 BC, however, there is a marked fall in pollen values for elm and lime. This is known as the 'elm decline' and is quite widely accepted as an artefact of the activities of Neolithic people. From this time onwards many changes are brought about by human activity, principally forest clearance and the spread of agriculture. The appearance of species such as common sorrel *Rumex acetosella* and cereals within pollen records were indicative of this shift towards pasture and arable production respectively.

Around 1410 BC, during the Bronze age, most tree pollen species decline and there are steep rises in values for grasses and sedges. These changes suggest forest clearance and the extension of pasturing, possibly of a more extensive nature than previously, with evidence for arable farming. In particular on the drier, more fertile and easier worked soils of the

magnesian limestone, clearance was very intense. It is likely that there was no reforestation from that time onwards. On the heavier soils of the Tees lowland there seems to have been very little clearance.

By the time the Romans arrived in the Iron age, the magnesian limestone plateau was probably cleared of forest, with quite intensive agriculture on the better soils and pastoral farming over much of the rest of the area. It is likely that trees only remained on the heavier soils, in wetter areas near streams and on inaccessible slopes such as the 'denes'.

This type of land management probably continued with little change until relatively recent times. During the seventeenth century there was reclamation and enclosure of many of the region's pastoral areas, which was a trend linked to the fact that the centuries of continuous cropping had begun to exhaust the land. The new pasture farms produced hay and dairy produce to supply demand created by the expanding coalfield in East Durham.

## 3.2 Recent and Present Management

### 3.2.1 Agriculture

Until 1800, agriculture and industry in Durham were complementary to one another. During the nineteenth century, there was a phenomenal expansion in industry and the economical importance of agriculture fell to second place (The Report of the Land Utilization Survey of Great Britain, 1941; Dunn, 1980). However, the great increase in population of the area produced a ready market for a range of agricultural products such as dairying, particularly perishable produce, and cash cropping of cereals and root crops, including potatoes. Hay and oats became cash crops with a steady demand being created by the growing numbers of pit ponies used in the nearby mines.

By the end of the nineteenth century, there was a considerable arable acreage in East Durham arising largely in an attempt to supply the growing industrial population with cereal and vegetable crops. Along with the arable, a considerable dairy industry had flourished, mainly concentrated on the heavier land overlying the coal measure areas immediately to the west of the escarpment. Sheep were of little importance but there was a considerable pig population well distributed throughout the area. Farms in general were small and practised traditional rotations carrying a number of enterprises. Farming practices at this time were mostly determined by the demands of the local markets.

With the adoption of new technology after the war, this pattern began to change. Specialization, amalgamation and a greater geographical concentration of farming enterprises gave considerable impetus to the increase in cereal farming which had begun in the industrial period. Even where grass became the major crop of an individual unit, it was usually for specialist dairy farming. Accompanying these changes were other effects; rotations were simplified, hedges and copses were removed to enlarge fields and grassland began to be treated as a crop with reseeding programmes and the use of fertilisers and herbicides. The general economic climate throughout this period meant that farming was under continual pressure to be increasingly efficient which meant more intensive farming. This in turn led to the successful reclamation of some of those areas that had been unsuitable in the past, such as wetlands, steep areas and rough grassland.
Mechanisation and the advances in the science of farming played an important role in the

greater specialization and uniformity of farms across the plateau. This resulted in the predominance of large scale arable farming, particularly of barley and wheat together with some subsidiary enterprises of fattening cattle and sheep

Current information has shown that intensive agriculture is by far the predominant landuse, covering 65% of the Natural Area (English Nature, 1994). Arable cropping is widespread, 33.8% of the plateau is in intensive production. Barley is the most important crop, the bulk of which is sold for feed. Other cereals include wheat and oats, the latter now of minor importance, grown almost entirely for home feeding of sheep. Oil seed rape has expanded dramatically over the past few years. Originally grown as a break crop for wheat, it has become profitable in its own right.

Other crops include potatoes, swede and cabbage, and a number of pick-your-own fruit farms. There is a substantial area of urban fringe farming which is predominantly cereal, the upkeep of livestock is difficult due to trespass and vandalism. Some farms have taken advantage of the large nearby market and grow potatoes and vegetables for local consumption. Some have farm shops.

Livestock farming is mainly sheep and dairy. The impetus of the EC Sheep Meat regime is evident in the increase of flock numbers and establishment of new flocks. Management levels are rising with the adoption of intensive 'clean' systems, the better use of fertiliser, winter housing and indoor lambing. Beef herds have almost receded from the lowlands due to the continued pressure on margins, the relative profitability of sheep and the crisis in the beef industry. Dairy farming is practised on a number of farms. Herds, mostly Friesian, are managed intensively, which has meant a trend towards silage based feeding regimes and an increase in nitrogen use on grassland (ADAS, 1983).

### 3.2.2 Mineral Extraction

**Quarrying**

The working of the magnesian limestone in Durham is described as several overlapping phases (Dunn, 1980). Each phase is given a period that represents its greatest activity.

**1. Lime Burning**

This was probably started in earnest during the mid to late eighteenth century. By the 1830's, ships were collecting lime manufactured from Fulwell stone direct from kilns on the banks of the River Wear. By the end of the century Fulwell Quarry was rail connected and production expanded. The high calcium stone was all worked out and the quarry and kilns were closed by 1957.

**2. Flux**

This phase was again to obtain the high calcium element and was brought about by the development of the North East as an iron producing centre. Much of the limestone used as a flux for the blast furnaces came from the Carboniferous series or the mountain limestone, but many magnesian limestone quarries provided a high calcium limestone for this purpose. Extraction for flux started around 1850 and continued in considerable value until about 1920

when they began to substitute high magnesian limestone for high calcium limestone in iron production.

### 3. Dolomite Refractory

Around 1870 it was discovered that a certain type of magnesian limestone when dead burnt, known as 'Doloma', made a suitable refractory lining in the production of steel. By the 1920's production of Doloma had expanded, supplying the steelworks in north east England and Scotland. Production ceased by the early 1970's.

### 4. Magnesium and Magnesite

In 1844 the first quantity of magnesia was produced from dolomite. At that time the product was used for pharmaceutical and rubber products. Later, by the mid 1890's, magnesia and asbestos insulation material was in production. One company alone extracted up to 100000 tons of magnesian limestone per year from Hylton Quarry at Sunderland. The Second World War revealed the strategic importance of magnesite as a high grade refractory and its production facilitated the manufacture of magnesia, magnesium metal, magnesium chloride and sulphate. Magnesite is still quarried for this process.

### 5. Agricultural Magnesian Limestone

The introduction during the last war of the agricultural Lime Scheme, and the recent trend for growing barley has encouraged a much greater use of lime. Durham has become an exporter for this product to areas with limited deposits of ground magnesian limestone.

### 6. Construction

Since the 1960's the construction industry has become the dominant market of magnesian limestone. As a result of a massive development programme at that time, traditional sources of roadstone and fill could not meet the heavy demands. Most of the magnesian limestone quarries are situated near the major developments to minimise costs for the transportation of bulkfill, hardcore, roadstone and coarse aggregate for concrete production. The construction boom in the Tyne Tees area over the decade 1965-75 saw the reopening of a number of old workings such as Bishop Middleham and Haswell Moor Quarries.

Magnesian limestone today has three main uses (Durham CC, 1979):-

1. The construction industry claims the largest use of magnesian limestone and dolomite for aggregates (roadstone, concrete manufacture and fill material). The associated Basal Permian Sands are also extracted for building.

2. Dolomite in the metallurgical and chemical industries, which require a relatively pure, high magnesium content rock.

3. Magnesian limestone and dolomite for agricultural lime, which tends to be a by-product of the other uses as fine material left over from crushing.

At present, most of the magnesian limestone and dolomite is produced from quarries at Raisby, Thrislington, Old Quarrington, Crime Rigg, Witch Hill and Aycliffe East, along with

Bishop Middleham which was reopened (Durham CC,1994). Several sand and gravel, and sandstone/limestone quarries are also operational in the area (NRA, 1994).

There are a number of derelict quarries as a legacy from the past that have re-colonized with calcareous grassland. Some of these areas contain a significant proportion of the conservation interest in the Natural Area and a number have been designated as SSSIs, including Bishop Middleham Quarry, Tuthill Quarry and Trimdon Limestone Quarry.

### 3.2.3 Coal Mining

Evidence suggests that coal has been used as fuel in the North East since the Iron Age. It was widely used during the Roman occupation and written records of coal extraction date from the twelfth century Monastic period. However, the coal trade did not develop in earnest until the sixteenth century, when demand expanded and boomed through the industrial revolution, persisting to the present day, although to a much lesser extent.

Coal mining was one of the first major industries in County Durham. The location of the coalfield was important in its early development. Shallow seams situated to the west of the escarpment and near the coast could be worked easily and transported by convenient rivers to the sea and exported to London. Towards the end of the eighteenth century, the industrial revolution created both new markets for coal and new techniques of coal production. The universal acceptance of the steam engine for power production and the invention of the railway, the locomotive and the steam ship, all of which were big coal consumers, together with the use of coke in iron smelting and illuminating gas, boosted the Durham coal mining industry. As the demand for coal increased, new pits were sunk further away from the rivers and coast, resulting in the growth of a transportation network.

County Durham is the oldest coal mining area in the country, which was exploited rapidly in the nineteenth century. As a result, while the country as a whole reached the high point of productivity in the 1880's, the intensively worked Durham coalfield had passed its peak. Production declined, reserves dwindled and older pits could not be worked cheaply and competitively. The war saw a collapse of the export trade, which resulted in a closure of the many collieries which depended on that trade. Most seams are now either worked out or uneconomic, leaving the remains of several collieries clustered along the Durham coast and occasional heaps of mining spoil dotted on the landscape. There are no deep mining activities at present on the magnesian limestone plateau, the last mines having closed in 1993.

Since the late 1950's, working coal by opencast methods has been developed. Shallow seams have been the target for operations, generally located on poor quality land. This has occurred mainly in the centre of County Durham. Whilst there are clearly no sites on the plateau (NRA,1994) they do extend right to the escarpment foot.

### 3.2.4 Urban and Industrial Development

Urban areas constitute around 20% of the DMLNA, a large proportion in the wider context; for County Durham as a whole the figure is about 7%. The largest settlement of Sunderland dominates the northern section of the area, whilst other major settlements are restricted to the plateau edges such as Peterlee, Newton Aycliffe and Seaham. Many of the settlements in the DMLNA are small and scattered, reflecting the historical dependence on the coal industry. Urban expansion and associated industrial development can pose direct threats to the nature

conservation resource of the DMLNA, particularly as a number of SSSIs in the Natural Area are situated along the urban fringe. The second tier sites of nature conservation importance that occur within urban areas take on greater local importance. Associated problems that affect these sites are inappropriate recreation, vandalism and illegal tipping. The logistics of positive conservation management of small inaccessible urban sites can also be a problem.

Conversely, the presence of a large population can provide opportunities for greater community involvement and awareness in sustaining the nature conservation resource of the DMLNA. A number of important geological sites are located around Sunderland and offer considerable educational potential.

## 3.3 Summary of Impacts on the Nature Conservation Resource

### 3.3.1 Grassland

Quarrying, mining and the intensification of agriculture, in particular, have combined to reduce and fragment the area of magnesian limestone grassland.

Species rich areas such as former unimproved pasture and calcareous grassland have been improved and converted to arable land, a phenomenon which continues today, albeit at a reduced rate. This has led to the loss of biological interest, both botanically and zoologically. Remaining areas of unimproved grassland are generally restricted to areas inaccessible to machinery, such as steep slopes and quarry edges. These areas are generally quite small and represent the some of the last remnants of species-rich magnesian limestone grassland in Britain.

Within these surviving areas, neglect is further reducing their value (Pritchard, 1989). Many of these small areas of unimproved grassland are a very marginal part of large arable farms. Their small size often means that essential grazing is not economically viable (Dalby, 1991). They are therefore often undergrazed and neglected. As a result, the swards become increasingly coarse and under threat from scrub encroachment, which can eventually cause acidification of soils and ultimately woodland development. Pritchard (1989) estimated that around 60% of magnesian limestone grassland sites in the DMLNA were suffering from scrub invasion and that the total extent of this habitat type could increase by up to 15% given positive management. Since that time English Nature have made considerable strides in reclaiming grassland through a Wildlife Enhancement Scheme (WES), although this mechanism is not available for non-SSSI sites which continue to decline. Targeting other incentive schemes on non-SSSI grasslands is currently a major gap in procedure which needs to be filled.

Even on grassland SSSIs, it has proved difficult to easily establish the correct management regime, particularly on some of the more urban sites. These sites depend on appropriate management in order to maintain their nature conservation interest, yet the necessary grazing in some areas is difficult due to the problems of stock availability, theft, vandalism and maintenance of boundaries. Although WES schemes allow for cutting to take place on sites as a substitute for grazing, the steep terrain and fragmented nature of many sites means that even this is difficult, and labour-intensive operations such as hand-strimming and raking are necessary, which are more expensive and less attractive to agreement-holders.

A few sites are likely to be deteriorating in quality because of overgrazing. This process prevents plants from flowering and seeding and so may impose a limit on the viability of small populations of constituent species. It can also favour weedy species through the creation of sward gaps and local nutrient enrichment.

Mineral extraction has also been responsible for much of the habitat loss during the past 200 years. The impact of quarrying is a total loss of vegetation overlying the area and disturbance and dust build up on neighbouring land. However, the recolonisation of some derelict quarry sites has taken place, which has partially compensated for the loss of semi natural calcareous grassland. Primary and secondary limestone grasslands occur at old quarry sites and represent a significant proportion of the remaining conservation interest. As a result, several of these areas have merited SSSI status. Appropriate restoration of existing quarries can allow the development of magnesian limestone grassland whilst reworking of disused quarries can threaten these secondary habitat types.

In addition to the management problems previously discussed, old quarries can be tempting waste disposal sites and some of the conservation interest has been affected due to illicit and authorized tipping (Doody, 1977). Spoil heaps created as a result of extraction also directly led to a loss of grassland habitat.

Recent initiatives such as Countryside Stewardship and English Nature's Magnesian Limestone Grassland WES scheme are the main incentives for landowners to continue or restore management of existing grassland sites and create new areas of limestone grassland. The management of quality non-SSSI sites must be addressed in the near future. In addition, traditional management of hay meadows and pastures can be encouraged.

### 3.3.2 Broadleaved Semi-Natural Woodland

Woodlands in the Natural Area are scarce, as discussed previously. It is likely that none have retained a canopy undisturbed by man since the forest maximum, prior to the arrival of Neolithic man.

Evidence from OS 1" map (Doody, 1977) shows woodland to be slightly more extensive a hundred years ago. It is likely that some has been lost to agriculture or removed in the course of quarry operations. Replanting of semi-natural woodland with non-native species has also taken place in Durham and Tyne & Wear. The majority of this habitat type is now restricted to the coastal denes. The problems here include recreational pressure from neighbouring human populations and sporadic illegal tipping (Doody, 1981), and deterioration in species-composition due to the currently poor regenerative capacity of some native species (including Oak), dutch elm-disease and invasion by alien plants such as Rhododendron, Himalayan Balsam, Japanese Knotweed and Sycamore. Control of these species, necessary in order to restore a more natural species-complement which generally is more favourable to native wildlife, is costly, time-consuming and fraught with difficulty. Eliminating or even controlling Sycamore is particularly problematic because it is particularly well-established, and because of removal of mature trees may be a conflicting landscape issue; it is certainly one unpopular with the public.
The Woodland Grant Scheme and, to a lesser extent, the Wildlife Enhancement Scheme provide a means of restoring the natural diversity of the magnesian limestone woods.

### 3.3.3 Wetlands

A number of wetlands have been reclaimed for agricultural purposes with loss of wetland communities and species; this is a process which continues to the current day. Others have deteriorated in quality because of increased nutrient inputs and because farm ponds - once central to the farm business - are now subject to lack of routine maintenance. In addition there is circumstantial evidence for drying of (sometimes important) spring and flush wetlands because of the exceptionally low rainfall over the last two decades. It is difficult to address such insidious threats, which appear to be affecting several SSSI and, collectively, a suite of endangered plant species itemised in Table 2.

These losses, often of ancient habitat, have only been partially compensated for by the appearance of new ponds as a result of mining subsidence, although these may benefit mobile species such as the Great Crested Newt. Other man-made wetlands such as storage reservoirs provide suitable conditions for breeding and migratory waterfowl.

### 3.3.4 The Coast

The Durham coast is one of the most badly despoiled in Britain (Durham County Council and Easington District Council, 1982). Since the second half of the nineteenth century colliery waste had been tipped over the cliffs and onto the beaches, a process which ceased only recently in 1993. As a consequence the bays between Dawdon and Crimdon have filled up and raised beaches have been formed with pit stone and slurry from coal washes.

However, this spoil has conferred a degree of buffering from marine erosion on the sea cliffs, and now dumping has ceased the coast is expected to erode at an increasing speed. In some areas there is already a problem with the erosion of lower parts of the cliffs where some of the most important flush communities are located (Barrett, 1993). Increased undercutting of the cliffs and the subsequent slippage of drift deposits creates changes in local water levels and flush communities are susceptible to burial or begin drying out (Cooke & Gray, 1984). In addition, some areas of calcareous and paramaritime grassland may be lost as a direct result of renewed coastal erosion.

In 1996 the project "Turning the Tide" was launched, a partnership project of local authorities, conservation bodies and other groups, which has the aim of restoring both environmental and socio-economic conditions in the coastal area. One aim of the project is to acquire arable land for permanent pasture re-creation on the plateau immediately behind the eroding cliffs, to promote the return to a more natural system whereby the erosion of coastal vegetation can be accommodated by adequate "reserves" of semi-natural habitat. The project will also remove two large colliery spoil-heaps at Horden and Easington, re-exposing the natural contours of cliff and beach.

It is expected that the necessary subsequent management of these plateau areas would be delivered by the Countryside Stewardship scheme. WES could also encourage the restoration of grazing management to neglected grassland sites, or ameliorate unfavourably heavy grazing regimes, given proper targeting. However, uptake may be limited in view of the payments available. Furthering such management agreements on non-SSSI sites should be given high priority.

The expansion and intensification of arable land at the top of the cliffs has lead to the eutrophication of damp grassland and, in particular, the Durham Coast flush communities Rubbish dumping along the cliffs and the leaching of fertilizer from adjacent agricultural fields may be a significant problem affecting large areas of important cliff vegetation (Mitchell *and others*. 1994). This results in the increased growth of rank vegetation such as coarse grasses and common herbs at the expense of the rare, less competitive species. Arable species are also encroaching onto semi -natural vegetation.

The use of motorbikes, four wheel drives, mountain bikes and horses are also causing erosion and damage to the conservation interest. Vandalism and fly tipping is also a problem, particularly on many of the urban fringe sites.

### 3.3.5 Species

Direct loss of habitat or a deterioration in its quality are the principal threats to a number of species which occur in the Natural Area. The scarcity of wetlands and grasslands reflect the status and distribution of several uncommon species. The Durham Argus is probably the most characteristic animal associated with the DMLNA, relying specifically on magnesian limestone grassland and the presence of its foodplant the rockrose. Lack of management has primarily been the cause of a number of local extinctions and represents the greatest threat to Argus colonies (Ellis, 1993, Leakey & Ellis, 1994). The loss of grassland habitats mainly through agricultural intensification has affected the invertebrate interest of the Natural Area. One-third of butterfly species recorded in the Natural Area in 1850 had been lost by 1990 (Dunn & Sheppard, 1980; Ellis, 1991).

A number of vascular plant species have already been lost as a result of habitat loss and undermanagement. Table 2 shows several other key species are at a critical state. Graham (1988) notes some 68 species lost in County Durham alone this century including several that were typical of the DMLNA.

Habitat fragmentation as a phenomenon distinct from habitat loss is a subject which has long attracted debate. It is probably particularly relevant to species on the Magnesian Limestone where habitat fragmentation has been severe, where several long-standing populations of species of great concern are present in very small quantities (such as *Primula farinosa*, *Epipactis atrorubens* and the Durham Argus) and there are limited or no opportunities for recolonisation because of the lack of corridors or vectors. Climate change and genetic impoverishment are real issues for some of these populations which are now critically threatened. Seed collection and cultivation of wild material is needed in some instances as an emergency operation. The Durham Argus seems comparatively secure on the coast, where two strong and dynamic clusters of populations exist, which would probably permit recolonisation within each cluster if there were local extinctions. On the escarpment, however, this is no longer the case in almost all instances and colonies have been lost comparatively recently, as at Pig Hill. Although the amount of habitat has scarcely declined over the last 10 years, the number of populations of this butterfly have done so; habitat fragmentation has made natural recolonisation impossible, although formerly this would doubtless have occurred.

Production-control measures such as Setaside can provide some opportunity to influence farming regimes, benefiting scarce arable weeds and declining passerines and game birds via

the development of conservation headlands and fertiliser-free zones. A seed-collection programme for selected key species is now underway. The Wildlife Enhancement Scheme is also delivering benefits for the Durham Argus.

### 3.3.6 Earth Science

Although the reworking and extension of quarries in the DMLNA can damage important calcareous grassland sites, continued quarrying of the magnesian limestone has the potential to offer a continued supply of important geological exposures of nationally important strata Existing exposures in abandoned quarries require maintenance due to the natural colonisation of vegetation and the accumulation of debris. Some important quarry sites are threatened with both legal and unauthorized tipping that leads to a complete loss of interest by infilling, or severely reduces the quality of exposures. Even more than for biological sites, there is an ongoing need to promote the educational value of earth science sites.

# 4. Visionary Objectives for the Natural Area

## 4.1 Key Objectives

### 4.1.1 Habitats

1. Sustain magnesian limestone grassland by:

    - Safeguarding all magnesian limestone grassland sites from development.

    - Achieving favourable, positive management for nature conservation on **all** SSSI magnesian limestone grassland **and** on primary CWS and undesignated magnesian limestone grassland sites. Manage sites to retain (or restore, where there is evidence of loss) their natural community diversity.

    - Doubling the total area of magnesian limestone grassland by taking all opportunities to recreate this habitat. Always ensuring sensitive habitat (re)creation schemes which respect landscape and vegetation community context Placing particular emphasis on:

    - linking existing primary grassland SNCIs and CWS by appropriate habitat recreation on natural landforms. Incorporate scrub plantings into such schemes;

    - increasing the amount of *Sesleria* grassland around those few primary areas on the plateau where it still occurs, and which are suitable for recreation of this type;

    - promotion of larger habitat (re)creation schemes in which occur large-scale habitat mosaic features, such as complete gradations from open grassland to mature scrub and woodland, woodland clearings and flush systems integral with permanent pasture.

    - the creation of appropriate new calcareous grassland habitat in the extreme south-west of the DMLNA (where *Sesleria* grasslands do not appear to be native), in an effort to decrease the fragmentation of the limestone grasslands of Durham and

Southern Magnesian limestone habitat generally.

2 Sustain neutral meadows and pastures by:

- Achieving favourable, positive management of all SSSI and ancient CWS hay meadows and pastures. Notification of new neutral grasslands (under-represented in the SSSI series to date) within the DMLNA is one important objective to partly achieve this.

- Increasing the area of species-rich neutral meadow and pasture in line with biodiversity targets by exploiting opportunities for the recreation of calcareous clay pasture, preferably "building" on existing sites. Using local seed-sources for habitat recreation, and respecting/recreating local variations in species complement.

3 Sustain woodlands by:

- Safeguarding all ancient woodlands from development

- Restoring the natural species-complement and community pattern of all SSSI woodlands.

- Within new planting schemes, achieving widespread recognition of the importance of using native species and native woodland types in their natural distributions, whilst recognising the needs of silviculture.

- Promoting the development of accessible, cheap, locally-sourced material for replanting.

4. Manage the DMLNA coast by:

- Resisting coastal defence works where there is no danger to life or property and allowing natural coastal processes of erosion and deposition to resume.

- Reverting cliff-top arable land to permanent pasture east of the Seaham to Hartlepool railway; manage existing grasslands under low-input regimes and to maximise their diversity.

- Following any gradual erosion of beach sediments, allowing maritime and inundation communities to develop naturally on the foreshore, especially at dene-mouths. Remove artificial structures which hinder the development of such natural communities.

5 Sustainably manage wetlands of nature conservation interest by:

- sympathetic management, and where appropriate diversification, of all SSSI and CWS sites. A present gap is in the management of CWS fens and ponds.

- securing favourable catchment-management around ancient and vulnerable

wetlands such as long-established basin mires, unpolluted ponds and M10 flushes;

- creation of new ponds, especially in the claylands of the south DMLNA, and where enhancement of Great Crested Newt populations is likely to result.

- maintaining or improving the quality of watercourses

6. Reverse the process of hedgerow-fragmentation. Recreate hedgerows sympathetically using local stock wherever possible, and with respect to the native distributions of hedgerow species.

7. Promote educational and community use of magnesian limestone sites where this is compatible with other land uses.

8. Exploit any opportunities which may arise as a result of new incentive schemes to diversify arable and farmland habitat, in order to benefit the declining farmland birds and arable weeds once characteristic of the Natural Area.

### 4.1.2 Species

1. Safeguard all nationally rare and scarce and DMLNA key plant species at their known current stations.

2. Re-introduce characteristic species to those localities where once reliably documented but now lost. As a general rule favour re-introduction schemes to introduction schemes as these may be more viable, and pay particular attention to species which are wholly extinct in the Natural Area or under threat there (eg, Durham Argus, Sword-leaved Helleborine, Green-winged Orchid, Juniper).

3. Reverse the trend of population decline for those more widespread animal species which are listed in the Biodiversity Action Plan, particularly those which are especially characteristic nationally of the DMLNA. eg Great Crested Newt.

1.3 Earth Science

1. Maintain and enhance the geological resource via:

- site clearance;

- agreed conservation measures in working quarries;

- assessment of the research-educational potential of new sites;

- the maintenance of natural coastal processes;

- the encouragement of joint conservation initiatives on sites with dual biological interest.

2. Promote the geological resource via:

- assessment and promotion of sites educational value and designation of new RIGS sites;

- on-site interpretation.

# 5. Bibliography

AGRICULTURAL DEVELOPMENT AND ADVISORY SERVICE. 1983. Farming in North East England. ADAS, Newcastle Upon Tyne.

ARMSTRONG, A., ed. 1992. *Birds of Durham, 1992*. Durham Bird Club.

ALEXANDER, M. 1980. Soils. In DUNN T.C., ed. *The Magnesian Limestone of Durham County*. Durham County . 40-44. Conservation Trust.

BALL S, G. 1986. *Invertebrate Site Register,* Parts 1 & 2. NCC, No. 69.

BARRETT, T. 1993. The Durham Coast SSSI Management Plan. English Nature, Newcastle upon Tyne.

BARTLEY, D.D., CHAMBERS, C., & HART-JONES, B. 1976. The vegetational history of parts of South and East Durham. *New Phytologist* **77**, 437-468.

BATTEN, L.A., BIBBY, C.J., CLEMENT P., ELLIOT G.D., & PORTER, R.F., eds. 1990. *Red Data Birds in Britain*. Poyser, London.

BATTEN, L. A. 1994. Natural Areas and their zones of opportunity. Internal report, English Nature, Peterborough.

BRATTON, J.H., ed. 1991. *British Red Data Books 3 - Invertebrates Other Than Insects*. NCC. Peterborough.

BROWN, A.F., & GRICE, P.V. 1993. Birds in England: Context and Priorities. *English Nature Research Report No. 62*, English Nature, Peterborough.

CLIFTON, S.J., & HEDLEY, S. 1995 *Durham Wildlife Audit: The distribution, abundance and conservation of wildlife in County Durham*. Durham County Council.

COOK, N.J. 1990. *An Atlas of the Butterflies of Northumberland and Durham*. Northumberland Biological Records Centre, Newcastle Upon Tyne.

COOKE, J.A, & GRAY, S. 1984. Nature Conservation on the Durham Coast - The Future. *Vasculum,* **69**, 84-87.

COOKE, R. 1987. Inventories of Ancient Woodland - Durham and Tyne & Wear. NCC, Peterborough.

DALBY, G. 1991. Magnesian Limestone - The Scientific Interest and National Importance. NCC Internal report, Newcastle Upon Tyne.

DAVIS, P. 1980. Vertebrates. In DUNN, T.C., ed. *The Magnesian Limestone of Durham County*. Durham County Conservation Trust. 71-75.

DOODY, J.P. 1977. The conservation of the semi-natural vegetation of the Magnesian Limestone- The Durham Escarpment. *Vasculum* 62, (3), 17-32.

DOODY J.P. 1980. The conservation of the semi-natural vegetation of the Magnesian Limestone - Tyne & Wear. *Vasculum*, 65, (3), 45-52.

DOODY, J.P. 1981. The conservation of the semi-natural vegetation of the Magnesian Limestone - The Durham Coast. *Vasculum*, 66, 17-27.

DUNN, T.C.,ed 1980. *The Magnesian Limestone of Durham County*. Durham County Conservation Trust.

DUNN, T.C., & SHEPPARD, D.A. 1980. Insects. In DUNN, T.C., ed. *The Magnesian Limestone of Durham County*. Durham County Conservation Trust. 69-71.

DURHAM COUNTY COUNCIL. 1979. Magnesian Limestone Escarpment Plan - Report of Survey. Durham County Council.

DURHAM COUNTY COUNCIL. 1994. *County Durham Structure Plan Review.* Consultation Draft Report 1994. Durham County Council.

DURHAM COUNTY COUNCIL & EASINGTON DISTRICT COUNCIL. 1982. *The Durham Coast - A Fresh Look at its Problems and its Future*. Durham County Council & Easington District Council Joint Report.

ENGLISH NATURE. 1993. *Natural Areas - Strategy for the 1990s*. EN Consultation paper, Peterborough.

ENGLISH NATURE. 1994. Durham and Tyne & Wear Phase I habitat data. English Nature, Newcastle upon Tyne.

ELLIS S. 1991. The distribution and abundance of butterflies on the Magnesian Limestone grasslands of County Durham. *Vasculum*, 76, 20-33.

ELLIS, S. 1993. Conservation Research on the Durham Argus Butterfly *Aricia artaxerxes ssp. salmacis* (Stephens). Contract Report, English Nature. Newcastle Upon Tyne.

EUROPEAN COMMUNITY 1992. Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora. *Official Journal of the European Communities* L206, Vol.35, Luxembourg.

GRAHAM, G.G. 1988. *The Flora and Vegetation of County Durham*. The Durham Flora Committe and the Durham County Conservation Trust.

GREEN, D. 1984. A Study of the Great Crested Newt *Triturus cristatus* in Durham and Tyne & Wear South. Durham County Conservation Trust.

GRICE, P.V., BROWN, A.F., CARTER, I.C., & RANKINE, C.A. 1994. Birds in England: A Natural Areas approach. *EN Research Report No.114*, English Nature, Peterborough.

HEDLEY, S., JULY, M., PUDE, G., DODDS, A., & REMFRY, A. 1994. A SSSI Resource Review with particular reference to Natural Areas. English Nature NE Region, Newcastle Upon Tyne.

HESLOP-HARRISON, J.W. 1947. The Blackhall Rocks. *Vasculum*, 32, 18.

HESLOP-HARRISON, J.W., & RICHARDSON, J.A. 1953. The Magnesian Limestone area of Durham and its vegetation. *Trans.Northumb.Nat.Union*, **2**, 1-28.

HINCHCLIFFE, G. 1994. Durham Bat Group, personal communication.

KEYMER, R.J., & LEACH, S.J. 1990. Calcareous grassland in Britain - a limited resource. In HILLIER, S.H., WALTON, D.W.H., & WELLS, D.A.,eds. *Calcareous Grassland - Ecology and Management.* Bluntisham, Huntingdon

LEAKEY, M. & ELLIS, S. 1994. Survey of populations of the Durham Argus *Aricia artaxerxes ssp. salmacis* Stephens on the Coast of NE England in 1994. English Nature. Newcastle Upon Tyne.

MARCHANT, J.H., HUDSON, R., CARTER, S.P., & WHITTINGTON, P. 1990. *Population Trends in British Breeding Birds*. BTO/NCC, Tring.

MITCHELL, D.N., DAVISON, A.W., & COOKE, J.A. 1994. The flora and vegetation of Magnesian Limestone sea cliffs, County Durham. *Trans.Nat. Hist.Soc. Northumb*. 57, 153-175.

MORRIS, P.A. 1993. *A Red Data Book for British Mammals*. The Mammal Society, London.

NATURE CONSERVANCY COUNCIL 1989. *Guidelines for the Selection of Biological SSSIs.* NCC, Peterborough.

NATURE CONSERVANCY COUNCIL 1990. *Handbook for Phase I Habitat Survey*. NCC, Peterborough.

NATIONAL RIVERS AUTHORITY. 1992. River Tees Catchment Management Plan Consultation Report. NRA, Northumbria & Yorkshire Region.

NATIONAL RIVERS AUTHORITY. 1994. River Wear Catchment Management Plan Consultation Report. NRA, Northumbria & Yorkshire Region.

PERRING, F.H., & FARRELL, L. 1983. *British Red Data Books 1- Vascular Plants*. RSNC, Lincoln.

PETTIGREW, T.H. 1980. Geology. In DUNN, T.C., ed. *The Magnesian Limestone of Durham County*. Durham County Conservation Trust. 7-27.

PRITCHARD, A. 1989. A Strategy for the Magnesian Limestone Grasslands. NCC Internal

report, Peterborough.

RATCLIFFE, D.A., ed. 1977. *A Nature Conservation Review*. Cambridge University Press, Cambridge.

RICHARDSON, J.A., DAVIS, B.N.K., & EVANS, M.E. 1980. Disused Quarries. In DUNN, T.C., ed. *The Magnesian Limestone of Durham County*. Durham County Conservation Trust. 61-69.

RODWELL, J.S., ed 1991. *British Plant Communities 1 - Woodlands and Scrub*. Cambridge University Press, Cambridge.

RODWELL, J.S., ed. 1992. *British Plant Communities 3 - Grasslands and Montane Communities*. Cambridge University Press, Cambridge.

SHEPPARD, D.A. 1994. English Nature. Personal communication

SHIMWELL, D.W. 1968. The phytosociology of calcareous grasslands in the British Isles. PhD thesis, University of Durham.

SHIRT, D.B., ed 1987. *British Red Data Books 2 - Insects*. NCC, Peterborough.

SMITH, D.B. 1994. *The Marine Permian of England*. GCR Series Volume 8. Chapman & Hall, London.

SMITH, K. 1970. Weather and climate. In DEWDNEY, J.C., ed *Durham County and City with Teesside*. Durham Local Exec. Committee of the British Association

STEWART, A., PEARMAN, D.A. & PRESTON, C.D. 1994. *Scarce Plants in Britain*. Joint Nature Conservation Committee, Peterborough.

WHEELER, B.D. 1980. Wetlands. In DUNN T.C., ed. *The Magnesian Limestone of Durham County*. Durham County Conservation Trust. 53-61.

WILLIAMS, P. 1989. NVC Survey of woodland communities at Castle Eden Dene National Nature Reserve. Unpubl. NCC report, Newcastle upon Tyne.