National Character Area profile:

15. Durham Magnesian Limestone Plateau

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Introduction

As part of Natural England's responsibilities as set out in the Natural Environment White Paper[1], Biodiversity 2020[2] and the European Landscape Convention[3], we are revising profiles for England's 159 National Character Areas (NCAs). These are areas that share similar landscape characteristics, and which follow natural lines in the landscape rather than administrative boundaries, making them a good decision-making framework for the natural environment.

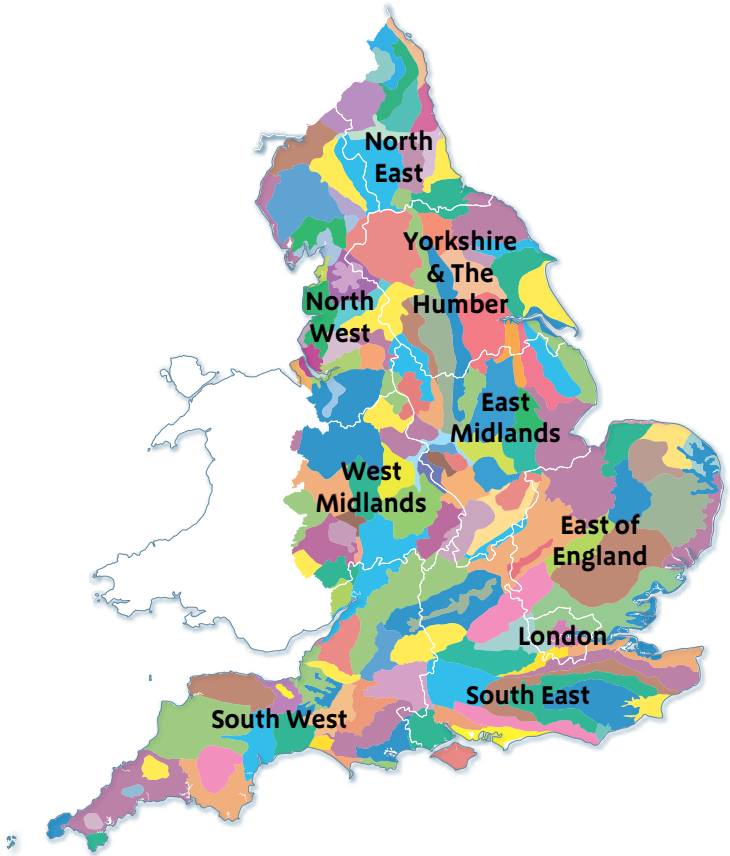
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and encourage broader partnership working through Local Nature Partnerships. The profiles will also help to inform choices about how land is managed and can change.

Each profile includes a description of the natural and cultural features that shape our landscapes, how the landscape has changed over time, the current key drivers for ongoing change, and a broad analysis of each area's characteristics and ecosystem services. Statements of Environmental Opportunity (SEOs) are suggested, which draw on this integrated information. The SEOs offer guidance on the critical issues, which could help to achieve sustainable growth and a more secure environmental future.

NCA profiles are working documents which draw on current evidence and knowledge. We will aim to refresh and update them periodically as new information becomes available to us.

We would like to hear how useful the NCA profiles are to you. You can contact the NCA team by emailing **ncaprofiles@naturalengland.org.uk**

National Character Areas map



[1] The Natural Choice: Securing the Value of Nature, Defra (2011; URL: www.official-documents.gov.uk/document/cm80/8082/8082.pdf)

[2] Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services, Defra (2011; URL: www.defra.gov.uk/publications/files/pb13583-biodiversity-strategy-2020-111111.pdf)

[3] European Landscape Convention, Council of Europe (2000; URL: http://conventions.coe.int/Treaty/en/Treaties/Html/176.htm)

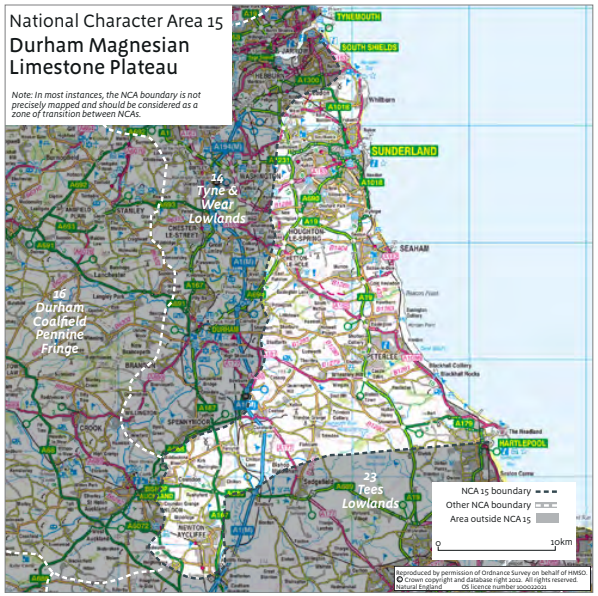
Summary

The Durham Magnesian Limestone Plateau is an open, agricultural landscape with sharply defined boundaries in the form of a steep limestone escarpment to the west and a dramatic coast of limestone cliffs, headlands and bays to the east. The River Wear cuts across the north of the area, flowing into the sea at Sunderland, and the River Skerne drains into the Tees Lowlands to the south. The Magnesian Limestone aquifer that sits below the area is an important source of drinking water for surrounding urban areas.

Rural land cover consists of arable land and grazing pasture, with small, isolated areas of wildlife-rich habitat such as Magnesian Limestone grassland and ancient woodland in the narrow valleys (or denes) running down to the coast. The coast is an important breeding and feeding area for migratory birds, and harbour porpoise frequents inshore waters. The area has been strongly shaped by its industry, with coal mining and quarrying in particular leaving a very clear mark on local landscapes and identity. Settlements range from larger urban areas such as Sunderland to the north and ex-mining towns with their distinctive terraces to the south and east, to scattered traditional stone villages built around village greens on the plateau and 'New Towns' such as Peterlee and Newton Aycliffe. Local nature reserves and a good access network, particularly along disused colliery railways and the coast, provide local residents with good opportunities for outdoor recreation.

The Durham Magnesian Limestone Plateau is an area of dramatic environmental restoration: the River Wear was named one of England and Wales' most improved rivers in 2011 and the Turning the Tide project has removed more than a million tonnes of colliery waste from the coast to restore kilometres of beaches.

Opportunities to protect and strengthen provision of ecosystem services in the area include management of agricultural and development land to protect water quality and allow groundwater recharge; protection and promotion of the area's industrial heritage which contributes so much to its sense of history and identity; protection and expansion of Magnesian Limestone grassland for the benefit of wildlife and sense of place; enhancement of the access network, particularly crossing points across major transport routes; and retaining the access and wildlife value of the coast by moving access routes back from the eroding coastline and extending habitats inland.



Click map to enlarge; click again to reduce.

The limestone escarpment forms the western boundary to the NCA, giving sweeping views over the Tyne and Wear lowlands and supporting species-rich Magnesian Limestone grassland, as here at Cassop Vale Site of Special Scientific Interest.

Statements of Environmental Opportunity

- **SEO 1**: Protect, expand and connect semi-natural habitats, particularly limestone grassland, and enhance management of agricultural land to provide a range of benefits to local people, wildlife and the wider environment.
- **SEO 2**: Protect and enhance the coast as a place of tranquillity and inspiration that supports wildlife and illustrates the area's industrial past.
- **SEO 3**: Protect, manage and enhance waterbodies, particularly the River Wear, to improve water quality and enhance their wildlife value.
- **SEO 4**: Protect and promote the area's rich archaeology and geology to enhance appreciation of its mining heritage, significant role within British industry, and important fossil record and prehistoric sites.
- **SEO 5**: Seek to ensure that where there is new development it preserves the area's strong sense of place, retains tranquil areas, is appropriate in a changing climate and improves quality of life for local residents.

Description

Physical and functional links to other National Character Areas

A striking, west-facing Magnesian Limestone escarpment forms a series of spurs and valleys which mark the western boundary of the National Character Area (NCA), and overlooks the Tyne and Wear Lowlands to the north and west, affording dramatic views of the City of Durham. The plateau drops gradually to the Tees Lowlands to the south and the Durham Coalfield Pennine Fringe to the south-west. Transport routes such as the A19 and the coastal railway form prominent features in the landscape and provide links to the north and south, but also detract from tranquillity and create physical and psychological barriers to public access.

The NCA's two main rivers connect it to surrounding NCAs. The River Wear rises from the high moorland of the North Pennines and flows through the Durham Coalfield Pennine Fringe and Tyne and Wear Lowlands before crossing the Durham Magnesian Limestone Plateau to drain into the North Sea at Sunderland. Water for domestic use is abstracted from the tributaries of the River Wear upstream of the NCA, and pollution from disused mines and spoil heaps in the Durham Coalfield Pennine Fringe and North Pennines affects the water quality. The River Skerne rises within the Durham Coalfield Pennine Fringe near Trimdon and then flows south to the Tees Lowlands where it joins the River Tees. The Wear Magnesian Limestone Groundwater body, which underlies the area, supplies drinking water for Hartlepool, and is an important source of water for other areas.

A number of migratory species are associated with the coast and the sea to the east of the NCA, providing functional links to much further afield. The coast provides winter feeding grounds for large numbers of wading birds, many of which are migratory. The River Wear is also an important route for salmon and sea trout passing through the area en route between the North Sea and spawning grounds in rivers upstream of the NCA.

There are commercial links with the sea and other areas along the coast, particularly through traffic into and out of Sunderland, Seaham and the deep water port at Hartlepool, for freight, fisheries and services for offshore industry. Hartlepool, on the very southern edge of the area, has increasing links with the offshore wind energy sector, through manufacture of parts for wind turbines and transport services.

The dramatic coast offers inspiring views and is of great importance for wading birds, rare plants, recreation and industrial archaeology.

Key characteristics

- Open, large-scale landscape with big fields, low hedges and few trees on the plateau tops, incised with stream valleys along limestone escarpment to the west and denes running down to the coast to the east.
- Dramatic coastline with exposed cliffs of limestone and boulder clay, undulating series of small, sheltered bays and headlands, flower-rich Magnesian Limestone grassland, steep-sided wooded coastal denes, and sand dunes and beaches that support large populations of waders and seabirds.
- Striking west-facing limestone escarpment forming a series of spurs and vales, heavily quarried but still supporting a mosaic of limestone grassland, scrub and woodland.
- Strong influence of historic mining industry on both local culture and the landscape, in the form of ex-coal mining towns and villages with distinctive surrounding areas of allotments and pony paddocks, reclaimed colliery sites, disused and existing railways, and industrial archaeology.
- A productive farmed landscape with a high proportion of large arable fields and some pasture for sheep and cattle grazing.
- Small, fragmented patches of limestone grassland supporting unique combinations of rare plant and invertebrate species.
- Historic villages subject to a high degree of 20th-century expansion.
- Widespread urban and industrial development in the north and major transport corridors throughout.

Coal mining is still very important to local identity. The fierce pride in the coal mining past is beautifully illustrated by this mural at Cassop Vale.

Ex-mining towns are a distinctive feature of the area, with their terraced houses of red brick and slate roofs.

The Durham Magnesian Limestone Plateau today

The Durham Magnesian Limestone Plateau forms a gently undulating plateau of large, open arable fields, with low hedges and few trees. It has dramatic, well-defined boundaries in the form of a steep limestone escarpment to the west and the coastline to the east. The escarpment rises to 193 m and is dissected by streams which have carved it into a series of incised valleys where broadleaved woodland, scrub and species-rich grasslands survive on uncultivated steep slopes. The coast is made up of limestone and boulder clay, eroded to form a series of cliffs, headlands and bays, peppered with sea caves and isolated sea stacks. The dominant streams of the area drain eastwards down the gently inclined slope of the Magnesian Limestone towards the North Sea. Short streams run off the escarpment westwards as tributaries of the River Wear. Streams from the southern part of the plateau drain south into the River Skerne.

The area has long been important for agriculture, and is now predominantly farmed for arable crops, interspersed with grassland for livestock production. Field patterns are a mixture of smaller 17th-century fields around villages, the escarpment and the coast, all subject to some enlargement and re-organisation, and large, regular 'surveyor enclosed' fields (mostly from around the 18th century) on the central clay plateau. Coal mining and limestone quarrying have had a big impact on the landscape. Although the last of the deep coal pits were closed in the 1990s, coal mining still plays a strong role within local culture and identity. The area was also once important for its sea fisheries, with fishing ports along the coast.

Habitats of high conservation importance include the Magnesian Limestone grassland which exists in small, isolated fragments, with concentrations along the western escarpment, the coast and the central area around Thrislington Plantation and Cassop Vale. It supports a unique assemblage of species at the northern and southern extent of their natural range, and many rare species such as bird's-eye primrose, dark red helleborine and orchid species (pyramidal, fragrant and bee orchids). Pockets of ancient ash and elm woodland survive in parkland, country estates, the River Wear Valley and coastal denes, such as Castle Eden Dene (a National Nature Reserve and popular recreation destination). The mixture of arable land and grassland supports breeding populations of farmland birds such as grey partridge and corn bunting. Water voles are present along some of the watercourses in the area, and the River Wear has a healthy population of salmon and sea trout. The coast provides feeding grounds for large numbers of wading birds and breeding grounds for little tern, as well as habitat for numerous other marine and littoral species.

The northern part of the plateau has a strong urban character, influenced by Sunderland and South Shields, larger former mining towns such as Easington, and the planned modern 'New Town' of Peterlee, where the colour and texture of the buildings reflect the influence of artist Victor Pasmore. Further south, former mining villages dominate the landscape with their Victorian terraces of red brick and Welsh slate. The villages have a distinctive industrial urban character, and are surrounded by features such as small pony paddocks, allotments and sheds. The plateau also has traditional stone-built villages clustered around village greens which formerly provided grazing and protection for livestock. Railway lines, the A19 corridor, and other infrastructure such as landfill sites, light industry and warehouses give an urban feel to many parts of the NCA.

Use of the area for access and recreation is primarily by local residents, although this may change with restoration of the coast and the creation of the England Coast Path. The area is well provided with nature reserves and access routes near residential areas, many of which are associated with reclaimed colliery sites and former mine railways. Disused railways and other cycle routes form good connections between settlements and enable commuting by bike. Poor crossing routes across major roads and railways still act as physical and psychological barriers in the access network. There are some key sites which offer a strong sense of tranquillity and inspiration, such as the coast and the denes. The cultural significance attached to parts of the coast has been recognised through its designation as a Heritage Coast.

The coastal railway has provided a barrier to development along the coastline, leaving an undeveloped stretch of flower-rich habitats in many places, as at Blackhall Rocks.

The landscape through time

The landscape of the area is defined by its underlying geology, most notably the Magnesian Limestone and overlying boulder clay. The Magnesian Limestone was deposited during the Permian, approximately 255 million years ago, when the area was on the margins of a shallow sea, known as the Zechstein Sea, which then covered much of northern Europe. The Permian climate was hot and arid, similar to the modern-day Sahara, and beneath the Magnesian Limestone lie yellow desert sands (quarried in places such as Sherburn Hill). As sea levels rose, the Permian deserts were inundated. Initially the Marl Slate, rich in fish fossils, was deposited and then the thick sequence of Magnesian Limestone. Magnesian Limestones of Permian age which underlay the area are a complex succession of calcium and magnesium carbonates with important fossil reef structures which developed around the margins of the Zechstein Sea.

The Permian Magnesian Limestone overlies Carboniferous Coal Measures rocks (around 310 million years old). Glaciations shaped the landscape into the one we see today. The last, late Devensian, glaciation 26,000 to 10,000 years ago removed nearly all evidence of earlier glaciations and scraped bare the western Magnesian Limestone escarpment. The ice sheet deposited layers of till (boulder clay) across the area, burying earlier river valleys. When the 500-metre-thick ice sheet melted new valleys were cut, including the Wear gorge at Sunderland and the denes that run down to the Durham coast. Tundra vegetation, of grasses, sedges, club mosses and herbaceous plants, gradually became established on the barren glacial landscape and was followed by an expansion of mixed deciduous woodland as the climate warmed. The sea level rose as the ice sheets melted, eroding the cliffs that now form the Durham coast. The coastal exposures reveal the most complete succession of Magnesian Limestone in the British Isles and are of international importance[4,5].

This NCA is a place of dramatic environmental restoration, particularly the removal of millions of tonnes of coal waste from its beaches under the Turning the Tide project.

[4] *Limestone Landscapes – a geodiversity audit and action plan for the Durham Magnesian Plateau*, British Geological Survey Open Report OR/09/007, DJD Lawrence (2009)

[5] Durham Geodiversity Audit, DJD Lawrence, CI Vye and B Young, British Geological Service (2004)

Humans probably migrated into the area in Mesolithic times (8,000 to 4,000 BC) but left marks on the landscape that are visible today only from the Iron Age (750 BC to 75 AD) when forest clearance for agriculture began. The limestone plateau has a high concentration of prehistoric barrows and cairns (such as Copt Hill and Warden Law barrows), and the coastal area is rich in remains from Mesolithic and Neolithic activity. There is also an important body of data relating to palaeo-environmental conditions in the southern part of this area in the interface with the Carr lands.

Hawthorn Dene, and the other coastal denes, safeguard valuable fragments of ancient woodland and often have historic transport structures such as this viaduct.

The area was well used during medieval times for agriculture, commerce and manufacture. Much of it was owned by the medieval Benedictine monastery at Durham and by the 'prince bishops', who between them controlled all of the land 'between Tyne and Tees'. Medieval settlements were essentially nucleated and planned villages, dating from the 12th and 13th centuries. Medieval agriculture was mixed, producing grain and cattle for the monastic estates, and farmsteads developed from the 15th century on estates.

Post-medieval enclosure and re-organisation resulted in a large number of deserted medieval settlements, large, regular field patterns and very low survival of pre-1750 farmsteads. The remaining commons and pastures were enclosed in the 18th century. Many of the linear farmsteads from the late 17th century and loose and regular courtyard farmsteads from the late 18th and 19th centuries still survive today.

The rich mineral wealth of the area has been exploited for many years, and continues to be in the case of a small number of active quarries for limestone and sand. The quarrying of limestone expanded rapidly in the late 18th century, for use in agriculture, construction, steel making and pharmaceuticals. The now-disused quarries are important for their geological exposures and have been colonised by a typical limestone flora. The underlying geology and glacial clays of the area supported the manufacture of glass and bricks (from laminated glacial clays at sites such as Birtley). The glacially deepened River Wear provided an ideal deep water channel for ship building in Sunderland, once reputed to be the biggest ship-building centre in the world.

The Carboniferous Coal Measures underlying the limestone yielded poor-quality gas and coking coal which was used by early steel and engineering industries. In the 19th century workers' villages sprang up next to the expanding collieries. The Durham Coast railway line, which runs north–south, was constructed to transport coal from the coastal mines. It has since formed a physical barrier which has limited the encroachment of built development onto the coastal landscape.

In the 1940s the planned 'New Towns' of Peterlee and Newton Aycliffe were built. The closure of the coal mines in the 1980s and 1990s was followed by the removal of the distinctive colliery structures and the reclamation and environmental improvement of former colliery sites for new housing, mixed-use development and green space. Despite the closure of all the pits in the area, mining is still important to the sense of identity in the former colliery towns and villages. The decline of the local fishing industry had a significant influence on the landscape and economy of places such as Sunderland, Seaham and Hartlepool. The fishing industry in the area has been in decline since the 1980s and 1990s partly as a result of collapses in North Sea fish stocks. The decline of ship building was also a serious blow to the economy and community of Sunderland, and influenced the landscape.

Other changes in the 20th century included increases in field size and removal of hedgerows, the introduction of new crops such as oilseed rape, the decline of elm trees through Dutch elm disease, and the introduction of new features such as overhead power lines, telecommunication masts and wind turbines. The end of the 20th century saw an expansion in transport and commercial development.

At the beginning of the 21st century development continued (urban expansion and infilling around Sunderland, Peterlee and Hartlepool and along the A182). There has been some woodland expansion and restoration of hedgerows. Arguably the most dramatic change to the landscape in the early 21st century was the clearing of 1.3 million tonnes of colliery waste from the coast by the Turning the Tide project. This was accompanied by other work along the coast to return large areas (around 250 ha) of arable and brownfield sites to semi-natural grassland and create new coastal access routes.

Ecosystem services

The Durham Magnesian Limestone Plateau NCA provides a wide range of benefits to society. Each is derived from the attributes and processes (both natural and cultural features) within the area. These benefits are known collectively as 'ecosystem services'. The predominant services are summarised below. Further information on ecosystem services provided in the Durham Magnesian Limestone Plateau NCA is contained in the 'Analysis' section of this document.

Provisioning services (food, fibre and water supply)

- **Food provision**: This is a landscape dominated by arable production, primarily wheat, oilseed rape and winter barley. The area also produces lamb, milk and beef, with a small sheep flock and small dairy and beef herds. The local dairy herd has reduced in numbers in recent years, contrasting with an increase in the local beef herd, in line with national trends. Small quantities of fish are caught off the east coast, but there is no longer a major fishing industry.

- **Water availability**: The Magnesian Limestone bedrock beneath the area forms part of a major aquifer supporting several abstractions for domestic supply throughout the area at Seaton, North Dalton, Dalton Piercy, Hawthorn, Thorpe, Peterlee, New Winning and Red Barnes, and it is also the sole source of drinking water for Hartlepool. This aquifer is currently considered to have surplus water available for abstraction. The main concern with the integrity of the water supply relates to rising levels of water in the underlying Coal Measures, with high sulphate concentrations and other pollutants entering the aquifer from disused mines.

Regulating services (water purification, air quality maintenance and climate regulation)

- **Regulating water quality**: Current records suggest that surface waters throughout most of the area are of moderate ecological quality, with some river stretches considered as being of poor quality (such as Castle Eden Burn). Groundwater quality is classified as poor. The main threats to water quality in the area are pollution from landfill sites and disused mines, saline intrusion of the aquifer and diffuse pollution from agriculture.

Large numbers of allotment sites were created for colliery workers by the National Coal Board, these are still actively used to produce food and a strong feature in the landscape around colliery towns.

- **Regulating coastal flooding and erosion**: *The River Tyne to Flamborough Head Shoreline Management Plan Final Report* (February 2007) identified that along parts of the Sunderland coast there are issues of coastal erosion and coastal squeeze. Most of the coast is not at risk of flooding from the sea (an exception being low-lying parts of Hartlepool). Current rates of erosion present an increased risk of pollution from landfill sites situated alongside the coast. The natural topography of bays and headlands limits long-shore transportation of sediment.

Cultural services (inspiration, education and wellbeing)

- **Sense of place/inspiration**: The area has a strong sense of place which is heavily influenced by the history of mining in the area and the effect of the limestone on its agriculture, habitats and wildlife. Inspiration is provided by the opportunity to access natural areas at first hand on a daily basis by the good network of off-road access routes and nature reserves in this area. The coast in particular is an inspirational setting, due to its beauty and the success of recent environmental restoration.

- **Sense of history**: The area has a strong pride in its recent industrial past. It also has a wealth of reminders of the more distant past, such as a significant fossil record, prehistoric earthworks, and medieval settlements and field patterns.

- **Tranquillity:** The high proportion of built-up areas reduces the perception of tranquillity. However, the coast, the sea, the River Wear and the enclosed coastal denes retain a strong sense of tranquillity and can feel distant from the industry, transport corridors and development that predominate in some parts of the NCA.

The coast provides an inspiring, tranquil location for people, particularly local residents, to "get away from it all" and take part in a wide range of activities including walking, fishing, watersports and bird-watching.

- **Recreation**: Aspects that are particularly important for local residents are the open spaces offered by reclaimed quarries and colliery sites. Also of great value are the clean beaches, coastal nature reserves and walks, restored and created under the Turning the Tide project from 1997 to 2002. There is also a good cycle and footpath network based around former railway lines.

- **Biodiversity**: The NCA is the only place in the world where the blue moor grass/small scabious Magnesian Limestone grassland vegetation community occurs. Wildlife watching and viewing opportunities are provided by many sites, particularly along the coast and at inland reservoirs. Coastal dene woodlands provide locations for visitors to see rich spring woodland flora. Many of the area's disused quarries support a number of rare flower species including bee orchids.

- **Geodiversity**: The geology of the area has been the principal driver for mining and mineral processing industries. The NCA has 11 geological Sites of Special Scientific Interest (SSSI) and a further 7 mixed biological and geological sites (including most of the coastline as the Durham Coast SSSI).

Statements of Environmental Opportunity

SEO 1: Protect, expand and connect semi-natural habitats, particularly limestone grassland, and enhance management of agricultural land to provide a range of benefits to local people, wildlife and the wider environment.

For example, by:

- Expanding, buffering and connecting existing grassland, wetland and woodland sites, particularly where this will help to protect them from negative influences from surrounding land such as nutrient enrichment or tree/scrub encroachment, and where it will increase the permeability of the landscape for native species.
- Building on the area's historic hedgerow network to establish new hedgerows and boundary trees where these will enhance habitat connectivity and help to reduce surface water flows and soil erosion.
- Encouraging production and marketing of meat from low-intensity grazing of Magnesian Limestone grassland.
- Identifying and protecting suitable donor sites to provide seed for the creation of new areas of species-rich grassland.
- Encouraging the creation of Magnesian Limestone grassland on green roofs as part of new developments, particularly where industrial or residential developments subdivide limestone outcrop areas or where these can be used as an educational resource.
- Encouraging farmers to retain permanent grassland, particularly Magnesian Limestone grassland, except where greater environmental benefits can be gained by converting species-poor swards to wetland or woodland.
- Encouraging best practice farming techniques to maintain soil structure and organic matter (such as minimum tillage, use of green manure/cover crops, aeration, incorporation of organic matter and appropriate timing of machinery use) for the range of benefits that this can provide, including increased food production and plant/animal health; reduced run-off and water pollution; improved aquifer recharge; reduced soil erosion; and increased carbon storage.
- Supporting research on the agronomic benefits of species-rich grassland restoration and creation, particularly for pollination and pest control, and using any positive results to encourage habitat restoration/creation by local farmers.
- Encouraging the creation of grassland buffer strips in strategic locations in arable areas, alongside hedges and watercourses, between fragments of species-rich grassland and across erosion/run-off pathways, to provide benefits for water quality, soil erosion, pest control and pollination, and to enable wildlife to move through the landscape.
- Protecting existing species-rich grassland from new development and tree/woodland planting.

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SEO 1: Protect, expand and connect semi-natural habitats, particularly limestone grassland, and enhance management of agricultural land to provide a range of benefits to local people, wildlife and the wider environment.

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- Ensuring that new woodland planting is appropriate in terms of landscape character, species composition, and location with respect to existing priority habitats, archaeology and access/recreation.
- Protecting coastal denes from invasive species, reducing their vulnerability to diseases and ensuring quick action to control any outbreaks.
- Encouraging and supporting farmers to create feeding and breeding habitat for scarce farmland birds such as grey partridge and corn bunting.

SEO 2: Protect and enhance the coast as a place of tranquillity and inspiration that supports wildlife and illustrates the area's industrial past.

For example, by:

- Protecting, maintaining and extending the area of Magnesian Limestone grassland along the coast, particularly to allow for the habitat to persist as the coast erodes. This may call for the exploration of novel approaches to accelerate habitat creation (for example, transfer of topsoil and therefore seed bank) to ensure that habitat expansion keeps pace with or exceeds habitat loss owing to coastal erosion.
- Protecting and buffering wooded coastal denes and maintaining their importance for access, tranquillity and wildlife.
- Protecting and maintaining important feeding and breeding grounds for seabirds and waders along the coast.
- Supporting activities to improve the condition of beaches along the coast, such as voluntary beach cleans and improvement of litter disposal facilities accompanied by promotion and policing of their proper use.
- Enhancing interpretation provided at sites along the coast, to help visitors understand the history of the area and its importance for industry and wildlife.
- Communicating and celebrating the industrial heritage of the coast, recent restoration of the coastline and the value of ex-industrial sites for wildlife.
- Seeking and supporting opportunities to develop the coast as a key educational asset.
- Enhancing access points to the coast to improve the safety, appeal and ease of visiting the area through measures such as enhanced public transport, better car parking, clear routes to the coast, better disabled access and safe crossing points across the coastal railway.
- Seeking opportunities to encourage access to and recreation on the coast for a wider mix of people, particularly women and families, by improving infrastructure and tackling anti-social behaviour issues.
- Supporting measures to improve public transport along the coast, including additional stopping points for settlements along the coastal railway.
- Protecting and retaining the undeveloped and tranquil nature of the coast, while allowing for improvements to infrastructure for access and recreation, by incorporating green infrastructure into new development nearby and managing increased visitor numbers to prevent disturbance to sensitive wildlife sites (such as internationally protected bird breeding grounds).

SEO 3: Protect, manage and enhance waterbodies, particularly the River Wear, to improve water quality and enhance their wildlife value.

For example, by:

- Encouraging good soil management on arable farms in order to maintain soil structure, thereby optimising infiltration of rainwater to the aquifer and minimising run-off, soil erosion and sedimentation of watercourses.
- Working with farmers to secure good farming practice in order to reduce run-off or leaching of nutrients, bacteria or agricultural chemicals into watercourses, while also enhancing soil structure, organic matter and fertility.
- Planning for continuation of measures, such as pumping, to prevent water from disused mines polluting ground and surface water.
- Seeking opportunities to improve the potential of the River Wear to support salmon and sea trout, such as installing fish passes and removing man-made features which are obstacles to migration.
- Securing better management of riparian habitats to conserve existing water vole and otter populations, and encouraging expansion of populations into new areas where this is viable, while being careful not to exacerbate the spread of alien invasive species such as mink.

SEO 4: Protect and promote the area's rich archaeology and geology to enhance appreciation of its mining heritage, significant role within British industry, and important fossil record and prehistoric sites.

For example, by:

- Protecting and appropriately managing the historic environment for its contribution to local character and sense of identity, and as a framework for habitat restoration and sustainable development.
- Conserving and interpreting archaeological earthworks and sub-surface archaeology, maintaining grass cover and encouraging removal from cultivation where possible, while recognising the potential for undiscovered remains.
- Improving the condition of heritage assets through appropriate management and seeking to reduce conflicting or unsympathetic management regimes.
- Seeking opportunities to improve access to and information about key historic sites, particularly industrial ones where mining infrastructure has been removed and the sites are without obvious context to the casual observer.
- Protecting and maintaining buildings of historic importance and encouraging use of traditional building materials and techniques, where possible seeking to limit the negative environmental impact of extraction/ reclamation of traditional materials.
- Supporting training in traditional building techniques.
- Protecting, maintaining and restoring historic parklands and their ancient trees and historic structures.
- Enhancing access to and interpretation of key geological sites, where appropriate, particularly those along the coast, those associated with quarries and those with fossil deposits.
- Using interpretation material to explain the links between the geology and the surrounding landscape and the influence that it has on topography, natural processes and habitats as well as settlement pattern, industrial history and the built character of the National Character Area.

SEO 5: Seek to ensure that where there is new development it preserves the area's strong sense of place, retains tranquil areas, is appropriate in a changing climate and improves quality of life for local residents.

For example, by:

- Seeking to ensure that any new coastal developments do not destroy the tranquillity and beauty of the coast, will not be vulnerable to or exacerbate flooding and are in line with the Tyne to Flamborough Head Shoreline Management Plan.
- Encouraging the incorporation of features into new development that will help communities and businesses to adapt to a changing climate (such as strategic tree planting for shade/shelter, permeable ground surfaces to reduce run-off, sustainable drainage and rainwater harvesting systems).
- Seeking to ensure that new development is designed and located so that it protects and enhances existing historic assets, wildlife sites, access routes and other elements of green infrastructure, particularly along the coast where it could help to take pressure off/prevent disturbance to sensitive wildlife sites.
- Exploring opportunities for using biomass planting to help to assimilate new development into the landscape.
- Seeking opportunities to improve the green infrastructure and sustainability of existing urban and industrial areas.
- Retaining allotments, creating new sites where they are justified by demand, and encouraging their active use for food production and health benefits.
- Enhancing access networks by identifying and addressing key gaps and obstacles in the existing network, and making existing routes more easy to use for a wide range of users.

Supporting document 1: Key facts and data

Area of Durham Magnesian Limestone Plateau National Character Area (NCA): 45,261 ha

1. Landscape and nature conservation designations

There are no National Parks or Areas of Outstanding Natural Beauty in this NCA. 14 km of the coast falls within the Durham Heritage Coast.

Source: Natural England (2011)

1.1 Designated nature conservation sites

The NCA includes the following statutory nature conservation designations:

Tier	Designation	Name	Area (ha)	% of NCA
International	n/a	Northumbria Coast; Teesmouth and Cleveland Coast	40	<1
European	Special Protection Area (SPA)	Northumbria Coast SPA; Teesmouth and Cleveland Coast SPA	40	<1
	Special Area of Conservation (SAC)	Durham Coast SAC; Castle Eden Dene SAC; Thrislington SAC	453	1
National	National Nature Reserve (NNR)	Castle Eden Dene NNR; Durham Coast NNR; Cassop Vale NNR; Thrislington NNR	327	1
	Site of Special Scientific Interest (SSSI)	A total of 52 sites wholly or partly within the NCA	933	2

Source: Natural England (2011)

Please Note: (i) Designated areas may overlap (ii) all figures are cut to Mean High Water Line, designations that span coastal areas/views below this line will not be included.

A number of sites are overlapped by designation, for example coastal SSSI are also covered by Heritage Coast, SPA, SAC and Ramsar designations.

There are 182 local sites in the Durham Magnesian Limestone Plateau area covering 1,288 ha, which is 3 per cent of the NCA.

Source: Natural England (2011)

- Details of individual Sites of Special Scientific Interest can be searched at: **http://www.sssi.naturalengland.org.uk/Special/sssi/search.cfm**
- Details of Local Nature Reserves (LNR) can be searched at: **http://www.lnr.naturalengland.org.uk/Special/lnr/lnr_search.asp**

- Maps showing locations of Statutory sites can be found at: http://magic.Defra.gov.uk/website/magic/ – select 'Rural Designations Statutory'

1.1.1 Condition of designated sites

SSSI Condition Category	Area (ha)	Percentage of NCA SSSI Resource
Unfavourable declining	6	1
Favourable	390	42
Unfavourable no change	28	3
Unfavourable recovering	500	54

Source: Natural England (March 2011)

- Details of SSSI condition can be searched at: http://www.sssi.naturalengland.org.uk/Special/sssi/reportIndex.cfm

2. Landform, geology and soils

2.1 Elevation

Elevation ranges from sea level along the coast to a maximum of just over 200 m on the limestone plateau which extends south-westwards from the North Sea coast. The average elevation of the landscape is 98 m above sea level.

Source: Natural England 2010; Durham Magnesian Limestone Plateau Countryside Character Area description

2.2 Landform and process

The area is dominated by the undulating Magnesian Limestone plateau which dips gently towards the east from a west facing escarpment. Natural outcrops of Magnesian Limestone occur along the west facing escarpment, valley sides and denes and, most spectacularly, along the coast where it continues to erode into a series of bays, headlands and stacks such as Marsden Rock. Coastal 'denes' (deeply incised gorges) cut into the eastern edge of the plateau. Post glacial deposits of wind-blown sand form dunes along the coast to the south.

In the Sunderland section of the NCA, a small proportion of the low lying Tyne-Wear floodplain occurs where the River Wear cuts into thick clay - locally dominant drift deposits of the Tyne-Wear complex. Manmade landforms are widespread throughout the NCA as a consequence of extractive industries, especially coal and limestone extraction.

Source: Durham Magnesian Limestone Plateau Countryside Character Area description; Durham Magnesian Limestone Plateau Natural Area Profile

2.3 Bedrock geology

Magnesian Limestone occupies the whole of the NCA, deriving from sedimentary processes dating from the Permian period. Ninety per cent of this limestone is obscured by glacial drift deposits; surface outcrops cover only 0.1 per cent of mainland Britain, the majority of which are found within this NCA. Natural rock outcrops occur mostly in the low coastal cliffs and west facing escarpment. The complex nature of the Magnesian Limestone in the NCA is derived from a series of sedimentation events, culminating in distinct layers of Magnesian Limestone, classified as Lower, Middle and Upper Magnesian Limestone. The Upper Magnesian Limestone formation along the coast is distinctly categorised into three formations: Concretionary limestone's and "cannonball" rock; Hartlepool and Roker dolomites and The Sea formation. A

breakdown of solid geology as a proportion of total land area is as follows: 54 per cent Dolomitic limestone and argillaceous rocks; 32 per cent Dolomite rock; 9 per cent mudstone, siltstone and sandstone and 4 per cent sandstone.

Source: Durham Magnesian Limestone Plateau Countryside Character Area description; Durham Magnesian Limestone Plateau Natural Area Profile; British Geological Survey maps; Natural England (2010)

2.4 Superficial deposits

The Magnesian Limestone is generally obscured by a thin layer of glacial deposits; thick drift deposits of up to 100 m depth are found in the south of the NCA. There are also deposits of more recent alluvial sediments associated with the river systems, such as the River Wear sand and gravels.

Source: Durham Magnesian Limestone Plateau Countryside Character Area description; Durham Magnesian Limestone Plateau Natural Area Profile; British Geological Survey maps; Natural England (2010)

2.5 Designated geological sites

Tier	Designation	Number
National	Geological Site of Special Scientific Interest (SSSI)	11
National	Mixed Interest SSSIs	7
Local	Local Geological Sites	28

Source: Natural England (2011)

- Details of individual Sites of Special Scientific Interest can be searched at: http://www.sssi.naturalengland.org.uk/Special/sssi/search.cfm

2.6 Soils and Agricultural Land Classification

There are 9 main soil types identified within the area:

Rendzinas, found mainly on the 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 characteristically support an abundance of lime-loving plants and are directly associated with most of the remaining areas of limestone grassland.

Brown calcareous earths resulting from glacial drift deposits found at base of steeper slopes. Typically well drained, these deep calcareous soils produce the best grade of agricultural soils in the area.

Typical brown earths form well drained soils over non-calcareous parent rock, linked to glacial deposits, noticeably in vicinity of the Ferry Hill Gap. They are agriculturally productive if managed correctly.

Stagnogleyic brown earths developed where drainage was impeded. They are mainly found to the north and east of the NCA.

Cambic stagnogleyic soils occur where the typography is subdued and drainage is poor as a result of poor soil structure on clay loams. They are prone to seasonal water logging. This soil type is common over thicker drift deposits in the south-west of the NCA.

Cambic-humic- alluvial gleys are found in areas with high groundwater tables, such as the Wear and Skerne flood plains with alluvial or lacustrine deposits. Due to water logging their use is often limited to summer stock grazing.

Peat occurs in the lowest areas of alluvial and lacustrine deposits in the south-west part of the NCA. This soil type is now restricted to small irregular patches.

Raw sands are limited to unstable skeletal soils along the coast north of Hartlepool. These soils are very mobile and susceptible to wind blow, yet only penetrate less than 95 m inland.

Raw alluvial soils are poorly developed soils mainly limited to the valley floors of Wear and Skerne.

Source: Natural England (2012)

The main grades of agricultural land in the NCA are broken down as follows (as a proportion of total land area):

Grade	Area (ha)	% of NCA
Grade 1	0	0
Grade 2	285	1
Grade 3	32,390	72
Grade 4	391	1
Grade 5	0	0
Non-agricultural	1,240	3
Urban	10,700	24

Source: Natural England (2010)

- Maps showing locations of Statutory sites can be found at: http://magic.Defra.gov.uk/website/magic/ – select 'Landscape' (shows ALC classification and 27 types of soils).

3. Key water bodies and catchments

3.1 Major rivers/canals

The following major rivers/canals (by length) have been identified in this NCA.

- River Wear n/a
- River Skerne 13 km

Source: Natural England (2010)

Please note: Other significant rivers (by volume) may also occur. These are not listed where the length within the NCA is short.

Two main rivers dissect the NCA, the River Wear to the north, which flows east to meet the North Sea at Sunderland and the River Skerne, which flows south to meet the River Tees. The limestone scarp is dissected by many minor streams, and the plateau cut by deep gorges at the coast. The main rivers running through this NCA are captured under a programme of condition assessment and priority assessment of riparian and wider catchment features under the Defra and Environment Agency Northumbria River Basin District Management Plan: http://www.environment-agency.gov.uk/research/planning/124807.aspx

3.2 Water quality

The total area of Nitrate Vulnerable Zone is 26,223 ha, which is 58 per cent of the NCA.

Source: Natural England (2010)

3.3 Water Framework Directive

Maps are available from the Environment Agency showing current and projected future status of water bodies at:

http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e

4. Trees and woodlands

4.1 Total woodland cover

The NCA contains 3,403 ha of woodland, 7.5 per cent of the total area, of which 554 ha or 1 per cent of the NCA is ancient woodland. Parts of The Great North, and The Tees Community Forests, two of the twelve Community Forests established to demonstrate the contribution of environmental improvement to economic and social regeneration, cover 10,479 ha or 23 per cent of this NCA.

Source: Natural England (2010), Forestry Commission (2011)

4.2 Distribution and size of woodland and trees in the landscape

The NCA is generally sparse in woodland cover and there are few hedgerow trees. Broadleaved woodlands survive mainly on steeper uncultivated slopes including the scarp. The majority of woodlands are under 20 ha in size. Ancient semi-natural woodlands are particularly concentrated along the steep-sided coastal denes, for example Castle Eden Dene. Occasional broadleaved woods and exotic plantings are found within parkland and country estates, for example Elemore to the west of Haswell. Woodlands comprise ash and hazel, with occasional field maple and yew on thin limestone soils and oak on deeper soils. There are limited areas of mixed woodland.

Source: Durham Magnesian Limestone Plateau Countryside Character Area Description

4.3 Woodland types

A statistical breakdown of the area and type of woodland found across the NCA is detailed below.

Area and proportion of different woodland types in the NCA (over 2 ha)

Woodland type	Area (ha)	% of NCA
Broadleaved	2,297	5
Coniferous	472	1
Mixed	152	<1
Other	482	1

Source: Forestry Commission (2011)

Area and proportion of ancient woodland and planted ancient woodland within the NCA.

Type	Area (ha)	% of NCA
Ancient semi-natural woodland	510	1
Planted Ancient Woodland (PAWS)	45	<1

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

Low, frequently gappy hedgerows enclose most fields across the NCA. Hedgerows are characteristic in having few hedgerow trees. The NCA has a higher than national average uptake of agri-environment schemes with hedgerow management options, both for maintenance and new planting.

Source: Durham Magnesian Limestone Plateau Countryside Character Area description; Countryside Quality Counts (2003); Natural England (2011)

5.2 Field patterns

Large regular fields of 17th century enclosure and 18th century Parliamentary enclosures dominate. Peri-urban pressures have led to a break up of larger fields and have led to a mosaic of pony paddocks and allotments around larger settlements.

Source: Durham Magnesian Limestone Plateau Countryside Character Area description; Countryside Quality Counts (2003)

6. Agriculture

The following data has been taken from the Agricultural Census linked to this NCA.

6.1 Farm type

Cereal and livestock producing farms are the dominant farm types in the area. In 2009 there were 134 holdings classed as cereal units (43 per cent of holdings) and 61 lowland grazing livestock (19 per cent of holdings). There has been a significant decline in the number of dairy, general cropping and horticultural farms between 2000 and 2009.

Source: Agricultural Census, Defra (2010)

6.2 Farm size

Between 2000 and 2009 the average size of farms in the area remained largely constant, with a concentration of land in holdings larger than 100 ha; 27 per cent of holdings and 70 per cent of farmland.

Source: Agricultural Census, Defra (2010)

6.3 Farm ownership

Although the number of farms has increased since 2000, there is a notable decline of agricultural employment, particularly in terms of full time employment, despite numbers and sizes of farms remaining consistent.

2009: Total farm area = 25,987 ha; owned land = 19,283 ha

2000: Total farm area = 24,878 ha; owned land = 17,151 ha

Source: Agricultural Census, Defra (2010)

6.4 Land use

The dominant land use type is grass and uncropped land covering 11,423 ha or 44 per cent of the total farmed area. The second most dominant land use is cereals with 10,650 ha or 41 per cent of the total farmed area, reflecting the landscape's mixed agricultural character. Between 2000 and 2009 there was an 85 per cent decrease in the area of root crops, down from 770 to 117 ha, a 9 per cent decrease in cereal crops, down from 11,697 to 10,650 ha, and a 22 per cent increase in the area of grassland, up from 9,402 to 11,423 ha.

Source: Agricultural Census, Defra (2010)

6.5 Livestock numbers

The number of cattle produced in the area increased by 11 per cent between 2000 and 2009. Beef cattle production is often the next form of management undertaken by former dairy units, which have decreased in numbers. Sheep numbers fell by 26 per cent and pig numbers increased by 94 per cent from over the same time period.

Source: Agricultural Census, Defra (2010)

6.6 Farm labour

The figures show that most agricultural holdings are managed by owners with 74 per cent of land managed by owners and 23 per cent managed by tenants in 2009. There was a reduction in on-farm employment between 2000 and 2009, with a significant decline in full-time, part-time and casual employment. This is consistent with the national increase in use of farm contractors.

Source: Agricultural Census, Defra (2010)

Please Note: (i) Some of the Census data is estimated by Defra so will not be accurate for every holding (ii) Data refers to Commercial Holdings only (iii) Data includes land outside of the NCA belonging to holdings whose centre point is within the NCA listed.

7. Key habitats and species

7.1 Habitat distribution/coverage

Important fragmented areas of Magnesian Limestone calcareous grassland occurs on steep escarpment land and on cliff tops with unproductive soils. Unimproved neutral grassland, meadows, wetlands/reedbeds and heath, for example Hesledon Moor West SSSI, occur where the land is not cultivated, particularly on the plateau and coastal edge. Some areas of previously developed land and former colliery sites are important for the provision of mosaic habitats that are naturally colonising or for invertebrates such as the dingy skipper butterfly.

Maritime cliff and slopes cover a large area of the coast, with sand dunes at Crimdon Dene and South Shields, and the foreshore is important for wintering birds. Regionally important pockets of semi-natural ancient woodland occur within the coastal denes.

Source: Durham Magnesian Limestone Plateau Natural Area Profile

7.2 Biodiversity Action Plan (BAP) priority habitats

The Government's new strategy for biodiversity in England, Biodiversity 2020, replaces the previous Biodiversity Action Plan (BAP) led approach. Priority habitats and species are identified in Biodiversity 2020, but references to BAP priority habitats and species, and previous national targets have been removed. Biodiversity Action Plans remain a useful source of guidance and information.

More information about *Biodiversity 2020* can be found at:

http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/protectandmanage/englandsbiodiversitystrategy2011.aspx

The NCA contains the following areas of mapped priority habitats (as mapped by National Inventories). Footnotes denote local/expert interpretation. This will be used to inform future national inventory updates.

Habitat	Area (ha)	% of NCA
Broadleaved mixed and yew woodland (broad habitat)	1,159	3
Lowland calcareous grassland	504	1
Lowland meadows	336	1
Martime cliff and slope	251	1
Lowland dry acid grassland	250	1
Purple moor grass and rush pasture	231	1
Lowland heathland	58	1
Fens	45	1
Coastal sand dunes	42	<1
Reedbeds	12	<1
Mudflats	4	<1

Source: Natural England (2011)

- Maps showing locations of UK BAP priority habitats are available at: http://magic.Defra.gov.uk/website/magic/ select 'Habitat Inventories'

7.3 Key species and assemblages of species

- Maps showing locations of UK BAP priority habitats are available at: http://magic.Defra.gov.uk/website/magic/
- Maps showing locations of S41 species are available at: http://data.nbn.org.uk/

8. Settlement and development patterns

8.1 Settlement pattern

There are semi-rural agricultural villages in the south, often clustered around a grassy open space formerly used for the grazing and protection of livestock. A dominant pattern of 20th century coal mining villages has been superimposed onto the traditional settlement pattern; these are more numerous towards the coast. There are two notable planned 'New Towns' of Peterlee and Newton Aycliffe with distinct business, industrial and residential districts. There is widespread urban development with major infrastructure corridors and large industrial estates, with scattered mining towns and villages near the coast. Limestone quarries are prominent on the escarpment and areas of derelict or recently restored colliery land lie close to settlements. The traditional villages of the plateau, which still have some local stone-built houses clustered around central greens, contrast with Victorian brick-built terraces.

Source: Durham Magnesian Limestone Plateau Countryside Character Area description; Countryside Quality Counts (2003)

8.2 Main settlements

The main Settlements within the NCA are: Sunderland, Hartlepool (part – northern Hartlepool), South Shields (southern part), Houghton le Spring, Peterlee, Newton Aycliffe, Seaham and Hetton le Hole. The total estimated population for this NCA (derived from ONS 2001 census data) is 440,527.

Source: Durham Magnesian Limestone Plateau Countryside Character Area description; Countryside Quality Counts (2003), Natural England (2012)

8.3 Local vernacular and building materials

Traditional buildings are built of local Magnesian limestone for walls and slates for roofs. Contrasting uniform brick Victorian terrace houses with Welsh slate roofs are typical of the mining settlements, standing out in the rural landscape.

Source: Durham Magnesian Limestone Plateau Countryside Character Area description; Countryside Quality Counts (2003)

9. Key historic sites and features

9.1 Origin of historic features

Medieval agriculture was mixed, producing grain and cattle for monastic estates. Farmsteads developed from 15th century on estates, and with enclosure of common fields from this period were either relocated to new sites or left in village centres.

While some courtyard farmsteads survive from the medieval period, more common are the mixture of linear farmsteads dating from late 17th century and the loose and regular courtyard layouts of late 18th and 19th centuries. Farming was reorganised to match the demands and markets resulting from urban expansion, leading to larger farm units, operating on a semi-industrialised basis.

There are a large number of deserted medieval settlements, victims of post-medieval enclosure and reorganisation. Medieval settlement, essentially nucleated, was re-written after the 'Harrying of the North'. Planned villages were commonplace within the Palatinate of Durham, and survive best to the south of this character area.

The settled landscapes across the north of the area were transformed as industrial villages were established and expanded next to the collieries in the 19th century. These typically imported contrasting urban brick and Welsh slate terraces and rows into the rural landscape. There are a number of historic parklands and designed landscapes, including the 18th century Castle Eden.

There has been a long history of quarrying and mining associated with the area, expanding rapidly in the 18th century. Spoil heaps form distinctive landform features, and former quarries are now important both geologically and for nature conservation.

The Durham Coast railway line, originally constructed to transport coal, had an important influence on settlement.

Source: Countryside Quality Counts Draft Historic Profile, Durham Magnesian Limestone Plateau Countryside Character Area description

9.2 Designated historic assets

This NCA has the following historic designations:

- 7 Registered Parks and Gardens covering 314 ha
- No Registered Battlefields
- 30 Scheduled Monuments
- 693 Listed Buildings

Source: Natural England (2010)

- More information is available at the following address:
  http://www.english-heritage.org.uk/caring/heritage-at-risk/

  http://www.english-heritage.org.uk/professional/protection/process/national-heritage-list-for-england/

10. Recreation and access

10.1 Public access

- Four per cent of the NCA, 1,864 ha, is classified as being publically accessible.
- There are 661 km of public rights of way at a density of 1.4 km per km^2.
- There are no national trails within the NCA.

Sources: Natural England (2010)

The following table shows the breakdown of land which is publically accessible in perpetuity:

Access designation	Area (ha)	% of NCA
National Trust (Accessible all year)	337	1
Common Land	8	<1
Country Parks	154	<1
CROW Access Land (Section 4 and 16)	63	<1
CROW Section 15	2	<1
Village Greens	67	<1
Doorstep Greens	2	<1
Forestry Commission Walkers Welcome Grants	724	2
Local Nature Reserves (LNRs)	489	<1
Millennium Greens	1	<1
Accessible National Nature Reserves (NNRs)	327	1
Agri-environment Scheme Access	38	<1
Woods for People	775	2

Sources: Natural England (2011)

Please note: Common Land refers to land included in the 1965 commons register; CROW = Countryside and Rights of Way Act 2000; OC and RCL = Open Country and Registered Common Land.

11. Experiential qualities

11.1 Tranquillity

Based on the CPRE map of Tranquillity (2006) it appears that the lowest scores for tranquillity are associated with the urban areas of Sunderland, Seaham, Peterlee, Hartlepool, Ferryhill and Newton Aycliffe. The highest scores for tranquillity are associated with the deep coastal denes and the higher ground of the limestone plateau.

A breakdown of tranquillity values for this NCA is detailed in the table below:

Category of tranquillity	Score
Highest value within NCA	31
Lowest value within NCA	-91
Mean value within NCA	-19

Sources: CPRE (2006)

- More information is available at the following address: **http://www.cpre.org.uk/campaigns/landscape/tranquillity/our-tranquillity-map-explained**

11.2 Intrusion

The 2007 Intrusion Map (CPRE) shows the extent to which rural landscapes are 'intruded on' from urban development, noise (primarily traffic noise), and other sources of visual and auditory intrusion. This shows a similar pattern to the Tranquillity Map, with the main areas of disturbed land associated with the urban areas of Sunderland, Seaham, Peterlee, Hartlepool, Ferryhill and Newton Aycliffe.

A breakdown of intrusion values for this NCA is detailed in the table below.

Category of intrusion	1960s (%)	1990s (%)	2007 (%)	% change (1960s-2007)
Disturbed	63	69	72	9
Undisturbed	21	12	7	-14
Urban	15	16	21	6

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are associated with urban, new housing developments, and industrial, business and small scale retail park encroachment. New road infrastructure linking Ryhope to Seaham also contributes.

- More information is available at the following address: **http://www.cpre.org.uk/campaigns/planning/intrusion/our-intrusion-map-explained**

12. Data sources

- British Geological Survey (2006)
- Natural Area Profiles, Natural England (published by English Nature 1993-1998)
- Countryside Character Descriptions, Natural England (regional volumes published by Countryside Commission/Countryside Agency 1998/1999)
- Joint Character Area GIS boundaries, Natural England (data created 2001)
- National Parks and AONBs GIS boundaries, Natural England (2006)
- Heritage Coast Boundaries, Natural England (2006)
- Agricultural Census June Survey, Defra (2000,2009)
- National Forest Inventory, Forestry Commission (2011)
- Countryside Quality Counts Draft Historic Profiles, English Heritage (2004)*
- Ancient Woodland Inventory, Natural England (2003)
- BAP Priority Habitats GIS data, Natural England (March 2011)
- Special Areas of Conservation data, Natural England (data accessed in March 2011)
- Special Protection Areas data, Natural England (data accessed in March 2011)
- Ramsar sites data, Natural England (data accessed in March 2011)
- Sites of Special Scientific Interest, Natural England (data accessed in March 2011)
- Detailed River Network, Environment Agency (2008)
- Source protection zones, Environment Agency (2005)
- Registered Common Land GIS data, Natural England (2004)
- Open Country GIS data, Natural England (2004)
- Public Rights of Way Density, Defra (2011)
- National Trails, Natural England (2006)
- National Tranquillity Mapping data, CPRE (2007)
- Intrusion map data, CPRE (2007)
- Registered Battlefields, English Heritage (2005)
- Record of Scheduled Monuments, English Heritage (2006)
- Registered Parks and Gardens, English Heritage (2006)
- World Heritage Sites, English Heritage (2006)
- Incorporates Historic Landscape Characterisation and work for preliminary Historic Farmstead Character Statements (English Heritage/Countryside Agency 2006)

Please note all figures contained within the report have been rounded to the nearest unit. For this reason proportion figures will not (in all) cases add up to 100%.
The convention <1 has been used to denote values less than a whole unit.

Supporting document 2: Landscape change

Recent changes

Trees and woodlands

- From 1999 to 2003 there is some evidence of expansion of new woodlands in the former Great North Community Forest and the limestone areas to the south of the National Character Area. About 28 per cent of the woodland cover is on an ancient woodland site. The proportion of these sites covered by a woodland grant scheme agreement increased between 1999 and 2003 from 41 to 45 per cent.

Boundary features

- Historically there has been widespread removal of hedgerows and other field boundaries to create larger fields, particularly in arable areas. This trend has reduced, and in some cases, been reversed since the late 20th century with the advent of agri-environment schemes. Countryside stewardship uptake was generally at or above the national average between 1999 and 2003, with good uptake of options for maintenance or restoration of hedges (38 km and 81 km respectively). Between 2005 and 2012 there was strong uptake of environmental stewardship, with agreements including options for hedgerows amounting to 651.8 km of maintenance, 9.5 km of restoration and 9.5 km of planting of hedges.

Agriculture

- The loss of permanent grasslands observed between 1990 and 2000 slowed and was slightly reversed between 2000 and 2003. The extent of cereals and temporary grass declined between 1990 and 2003, while the area of set-aside increased.

- The number and size of farm holdings has remained largely constant.

- Between 1990 and 2003 there was a reduction in numbers of all livestock except for beef cattle. Between 2000 and 2009 this decrease continued with a reduction in sheep numbers of 26 per cent and an increase in cattle numbers of 11 per cent. The number of farm businesses classed as dairy reduced by 50 per cent over this period, so the increasing number of cattle is likely to be due to an increase in beef cattle.

- There was a notable decline in the number of employment opportunities on farms between 2000 and 2009, with a significant decline in full, part-time and casual employment. This is aligned to the national picture, in that more off-farm contractors are now employed to undertake mechanical operations, particularly in the arable sector.

- Between 2000 and 2009 an increasing amount of land was farmed by owners rather than tenants, with a 12 per cent decrease in tenanted land.

- Recent wet summers have made it difficult for farmers to avoid practices which are likely to damage soil structure. If the trend for wet summers continues it may cause changes in cropping patterns, crop types and the timing of operations, which will present a different set of challenges for soil quality.

Settlement and development

- Countryside Quality Counts (CQC) data suggests there is evidence of urban expansion and infilling, especially around Sunderland, Peterlee and Hartlepool, and upgrading of the A182. There also appears to have been significant development in the rural areas along the coast between Hartlepool and Peterlee, and along the A19 between Hartlepool and Wingate. Rates of new house building for County Durham as a whole was on average 1,429 houses a year between 2000 and 2010, although the rate fell between 2008 and 2011, with only 1,046 houses being built in 2010/11.

Semi-natural habitat

- The management of permanent grassland in the area has been enhanced under agri-environmental agreements, with 1,578 ha under environmental stewardship options for sympathetic management and restoration of permanent grassland between 2005 and 2012.

- Following the development of the Limestone Landscape and Durham Heritage Coast partnerships, considerable creation of species-rich limestone grassland has occurred (approximately 250 ha on former arable and brownfield sites), in some circumstances utilising agri-environment schemes, along the coast and escarpment spurs.

- Neglect and lack of management continues to be a threat to some habitats and species such as small Magnesian Limestone grassland sites which are difficult to graze and the little tern site at Crimdon which has become overgrown with marram grass, making tern chicks vulnerable to predation.

- Coastal and marine habitats have undergone substantial recovery since the removal of colliery waste, with Seasearch surveys from 2009 indicating improvements in the diversity and abundance of marine species. There were higher numbers of sessile filter feeding organisms, such as sponges, than found by the previous survey in 1991, indicating an improvement in water quality. The presence of a number of priority species was also recorded in 2009, such as plaice and common sole[6].

Historic features

- CQC data estimates that about 1 per cent of the NCA was historic parkland in 1918, but that by 1995 42 per cent of the 1918 area had been lost. About 33 per cent of the remaining parkland is covered by a Historic Parkland Grant, and 7 per cent is included in an agri-environmental scheme. There are suggestions that ancient parkland trees are in progressive decline and likely to disappear unless positive management is undertaken and replacement trees planted[7].

- About 17 per cent of historic farm buildings remain unconverted; most are structurally intact.

[6] *Durham Heritage Coast Seasearch Survey Report*, Seasearch North East (2009)
[7] *Durham Landscape Strategy*, Durham County Council (2008)

Coast and rivers

- The chemical water quality in 1995 was predominantly average, and it has been maintained.
- The River Wear was named by the Environment Agency as one of the most environmentally improved rivers in England and Wales in 2011, and salmon catches increased from 2 in 1965 to 1,531 in 2010.
- The Magnesian Limestone Groundwater body that sits beneath the NCA, and is the sole supply of drinking water for Hartlepool, has shown elevated levels of sulphate, chloride, sodium and nitrate in recent years, thought to be as a result of mine water inflows, abstraction and saline intrusion[8].
- Substantial investment via the Durham Heritage Coast partnership and the Turning the Tide Project (1997–2002) delivered a successful programme of waste removal and beach cleaning along stretches of the coast. Once formerly polluted from coal mining spoil, 80 ha of beaches and associated off-shore habitats have been restored.
- In general the erosion of the coastline along this NCA is slow compared with other parts of the English coastline. The colliery waste on some beaches will have slowed coastal erosion further by protecting the coast and cliffs, but stretches of the coast that have been cleared are now likely to be eroding at a rate of between 0.3 m and 0.5 m per year[9].
- The fishing fleet in Sunderland declined by 55 per cent from 2001 to 2003[10].
- The Durham Heritage Coast experienced a 25 per cent increase in the number of visitors in 2010/11[11].

Minerals

- Although most of the small-scale limestone quarries are no longer active, and are now more important for nature conservation than mineral extraction (many now designated as SSSI for their geological and biodiversity interest) the area still has some major limestone quarrying complexes (including Bishop Middleham and Thrislington) producing stone for construction. The coal-mining industry of the area ended in 1994 with the closure of the Wearmouth colliery in Sunderland.
- Many of the closed coal mines and quarries were reclaimed in the 1990s and 2000s to create a network of local nature reserves which are now of value for nature conservation, such as Colliery Wood at Boldon Colliery and Mainsforth and Fishburn Colliery Reclamation sites. Tree planting has taken place on many of the reclamation sites, which as they mature are giving a more wooded appearance to some areas.

[8] *Groundwater Quality Review: Skerne Magnesian Limestone*, Environment Agency (2008)
[9] *Shoreline Management Plan 2: River Tyne to Flamborough Head*, North East Coastal Authorities Group (2007)
[10] *Durham Heritage Coast Management Plan 2005–2010*, Durham Heritage Coast Partnership (2005)
[11] Niall Benson, Durham Heritage Coast Officer, pers. comm. (2013)

Drivers of change

Climate change

- Climate change in the Durham Magnesian Limestone Plateau, and the north-east of England in general, is predicted to result in warmer drier summers (an increase of 1.5–4.5°C, and decrease of 18–45 per cent precipitation by 2080), warmer wetter winters (increase of 1–3°C, and an increase of 10–28 per cent precipitation by 2080) and higher sea levels (6–66 cm by 2080). There are also likely to be increased extreme weather events in the form of heavy rainfall and storms leading to increased flooding and coastal erosion[12].

- Drier summers could lead to drought-stress for semi-natural habitats and agricultural crops. This in turn could lead to degradation and loss of certain habitats and species and increased abstraction of water for irrigation, with greater pressure on the Durham Magnesian Limestone Aquifer and the River Wear. Increased levels of water abstraction and higher water temperatures could have negative consequences for water quality, fish and other aquatic species and may cause greater incidences of algal blooms.

- Warmer drier summers and warmer wetter winters could increase the thermal growing season by between 40 and 100 days by 2080. This would provide improved conditions for the growth of biomass, both for wood fuel and energy crops, but may encourage greater intensification of farming.

- Warmer temperatures and changes in seasonal rainfall patterns could lead to changes in species composition of some habitats. There is likely to be a general northwards movement of species, possibly resulting in local extinction of those at the southern extent of their range, with particular consequences for habitats characterised by the presence of northern species, such as in the rare Magnesian Limestone grasslands.

- Hotter, drier summers may lead to a drying out of the basin mires in the south of the area and calcareous mires along the coast which would lead to locally significant carbon loss (albeit from a relatively small area).

- Increased frequency of heavy rainfall events could increase water-logging of soil, run-off and flooding, in turn causing increased pollution, sedimentation of watercourses and flooding of vulnerable settlements. This, combined with increased flashiness of rivers, could have negative impacts on riparian species such as water voles and fish species, particularly those that rely on clean gravels for spawning.

- Sea level rise and more frequent storm events may lead to increased rates of coastal erosion with sediment deposit dumped further down the coast. Impacts of this could include greater risk of contamination from landfill sites close to the coast, loss of rare coastal habitats, loss of property and erosion of coastal footpaths.

[12] *And The Weather Today Is – Climate Change in the North East,* North East Assembly (2002)

Other key drivers

- The North Eastern Local Enterprise Partnership (LEP) has set out the vision for the north-east of England to become '*Europe's premier location for low carbon, sustainable, knowledge-based private sector-led growth and jobs*', particularly in terms of production of electric vehicles, off-shore wind energy and other renewable energy industries.

- An enterprise zone has been designated within the NCA, for the production of low-carbon vehicles, on the A19 just outside Sunderland. This will allow new development to take place without the need for planning permission, as long as it is compliant with guidance and conditions set out in the relevant Local Development Order.

- There is likely to be continuing demand for the installation of more wind turbines in the area, both on land and offshore. The location and design of wind farms and individual turbines will need to continue to be carefully considered to maximise the energy contribution while avoiding negative impacts on the local landscape and environment.

- The area has already established itself as a base for industrial centres and warehouses, particularly because of its strong transport links (road, rail and marine), and it is likely that this type of development will expand, in line with the LEPs vision for the area.

Renewable energy is becoming an increasing focus for industry in the area.

- Development pressure is likely to continue with demand for additional housing and commercial premises bringing increasing urbanisation to parts of the landscape. This would also present positive opportunities such as creation of new green infrastructure and installation of more permeable surfaces and sustainable drainage or rainwater harvesting schemes.

- New development is most likely to be around existing settlement and transport routes to maximise economies of scale and reduce cost and pressure on transport infrastructure, thereby having greatest effect on the landscape of urban fringe areas. New industrial buildings can be particularly difficult to assimilate into the landscape, although opportunities for using tree or biomass planting for screening could be explored[13].

- A number of projects and partnership are actively carrying out work to improve the environment of the local area and protect its wildlife and heritage, including the Durham Heritage Coast, Limestone Landscapes Partnership and the Three Rivers Local Nature Partnership. These are likely to be the driving force for considerable habitat restoration and creation as well as greater understanding and appreciation among local people and visitors of the area's wildlife and heritage.

- Invasive species and diseases are likely to be an increasing threat.

- Small and fragmented areas of semi-natural habitats are likely to remain at risk of neglect, if their management continues to be economically unviable. Scrub encroachment of Magnesian Limestone grassland is a particular risk. This combined with increased movement (and possibly local loss) of species and diseases, climate change and genetic isolation of certain species could represent a severe threat to some rare habitats. However increasing food prices could make it more economically viable to graze livestock on these areas, and a changing climate could allow rare species from further south to extend their range into the area.

- Coastal erosion and more frequent storm events are likely to be a threat to valuable coastal habitats, particularly the cliff-top habitats and Magnesian Limestone grassland that exist in narrow strips along the coast.

- Recent work to remove colliery waste from long stretches of coastline is continuing to have a beneficial effect on marine and coastal species. As marine habitat continues to recover in response to better water quality and clearance of the layer of fine colliery waste on the sea bed, populations of marine species will continue to increase, with prey species having a beneficial effect on marine predators and some coastal species such as wading birds.

[13] *Durham Landscape Strategy,* Durham County Council (2008)

Supporting document 3: Analysis supporting Statements of Environmental Opportunity

The following analysis section focuses on a selection of the key provisioning, regulating and cultural ecosystem goods and services for this NCA. These are underpinned by supporting services such as photosynthesis, nutrient cycling, soil formation and evapo-transpiration. Supporting services perform an essential role in ensuring the availability of all ecosystem services.

Biodiversity and geodiversity are crucial in supporting the full range of ecosystem services provided by this landscape. Wildlife and geologically-rich landscapes are also of cultural value and are included in this section of the analysis. This analysis shows the projected impact of Statements of Environmental Opportunity on the value of nominated ecosystem services within this landscape.

The Magnesian Limestone geology has had a defining influence on the agriculture,buildings, industry and flora of the area, with many of the disused limestone quarries, such as Bishop Middleham Quarry SSSI, now of great value for their rare limestone flora.

Statement of Environmental Opportunity	Ecosystem Service: Food provision	Timber provision	Water availability	Genetic diversity	Biomass provision	Climate regulation	Regulating water quality	Regulating water flow	Regulating soil quality	Regulating soil erosion	Pollination	Pest regulation	Regulating coastal erosion	Sense of place/inspiration	Sense of history	Tranquility	Recreation	Biodiversity	Geodiversity
SEO 1: Protect, expand and connect semi-natural habitats, particularly limestone grassland, and enhance management of agricultural land to provide a range of benefits to local people, wildlife and the wider environment.	↗ **	↔ *	↗ **	↗ **	↔ *	↗ **	↗ **	↗ **	↗ **	↗ **	↗ *	↗ *	↔ *	↗ **	↔ **	↗ **	↗ **	↑ **	↗ **
SEO 2: Protect and enhance the coast as a place of tranquillity and inspiration that supports wildlife and illustrates the area's industrial past.	↗ **	↔ *	↔ **	↗ **	↔ *	↗ *	↗ **	↗ *	↗ **	↗ **	↗ *	↗ *	↔ *	↑ **	↑ **	↑ **	↑ **	↑ **	↗ **
SEO 3: Protect, manage and enhance water bodies, particularly the River Wear, to improve water quality and enhance their wildlife value.	↗ *	↔ **	↔ **	↔ **	↔ **	↗ **	↗ **	↗ **	↗ *	↗ **	↔ *	↔ *	↔ *	↗ *	↔ *	↗ *	↗ **	↗ **	↗ **

Note: Arrows shown in the table above indicate anticipated impact on service delivery: ↑ = Increase ↗ = Slight Increase ↔ = No change ↘ = Slight Decrease ↓ = Decrease. Asterisks denote confidence in projection (*low **medium***high) ° symbol denotes where insufficient information on the likely impact is available.

Dark plum = National Importance; Mid plum = Regional Importance; Light plum = Local Importance

Statement of Environmental Opportunity	Ecosystem Service: Food provision	Timber provision	Water availability	Genetic diversity	Biomass provision	Climate regulation	Regulating water quality	Regulating water flow	Regulating soil quality	Regulating soil erosion	Pollination	Pest regulation	Regulating coastal erosion	Sense of place/inspiration	Sense of history	Tranquility	Recreation	Biodiversity	Geodiversity
SEO 4: Protect and promote the area's rich archaeology and geology, to enhance appreciation of its mining heritage, significant role within British industry, and important fossil record and prehistoric sites.	↔ *	↔ *	↔ *	↔ *	↔ *	↔ *	↔ *	↗ *	↔ *	↗ *	↔ *	↔ *	↔ *	↗ **	↗ **	↗ **	↗ **	↗ **	↗ **
SEO 5: Seek to ensure that where there is new development it preserves the area's strong sense of place, retains tranquil areas, is appropriate in a changing climate and improves quality of life for local residents.	↔ *	↔ *	↔ *	↔ *	↔ *	↗ *	↗ **	↗ **	↔ *	↗ *	↗ *	↗ *	↔ *	↗ **	↗ **	↗ **	↗ **	↗ **	↔ *

Note: Arrows shown in the table above indicate anticipated impact on service delivery: ↑ = Increase ↗ = Slight Increase ↔ = No change ↘ = Slight Decrease ↓ = Decrease. Asterisks denote confidence in projection (*low **medium***high) ° symbol denotes where insufficient information on the likely impact is available.

Dark plum = National Importance; Mid plum = Regional Importance; Light plum = Local Importance

Landscape attribute	Justification for selection
Open, large-scale landscape with big fields, low hedges and few trees on the plateau tops, incised with stream valleys along limestone escarpment to the west and denes running down to the coast to the east.	■ In 2009 52 per cent of the farmed area was under some kind of arable production (cereal, oilseed, root crop or other). ■ Woodland cover is 7.5 per cent of the NCA and estimated boundary length is 2,208 km (or 0.05 km/ha). ■ A survey of hedgerows in County Durham conducted in 2006 highlights that threats to existing hedges include "overzealous mechanical trimming" and that there is a lack of recruitment of young hedgerow trees to replace a declining, and at times poorly-managed, mature stock.
Dramatic coastline with exposed cliffs of limestone and boulder clay, undulating series of small sheltered bays and headlands, flower-rich Magnesian Limestone grassland, steep-sided wooded coastal denes and sand dunes and beaches that support large populations of waders and seabirds.	■ The geological and cultural significance of part of the NCA's coastline have been recognised through recognition as a Heritage Coast. ■ The high value of the coast for coastal habitats and assemblages of birds has resulted in a number of European nature conservation designations including: the Northumbria Coast and Teesmouth and Cleveland Coast Special Protection Areas (SPAs) for birds and the Durham Coast Special Area of Conservation (SAC) for plant communities. ■ Many of the coastal denes are designated as SSSI in recognition of the nature conservation value of the ancient woodlands they contain. Castle Eden Dene is also a National Nature Reserve and SAC.
Striking west-facing limestone escarpment forming a series of spurs and vales, heavily quarried but still supporting a mosaic of limestone grassland, scrub and woodland.	■ The NCA is the only place in the world where the CG8 (blue moor grass / small scabious) Magnesian Limestone grassland vegetation community occurs. ■ The convoluted edges of the limestone escarpment result in a number of highly visible spurs, some of which have dramatic monuments on top such as Penshaw Monument.

Landscape attribute	Justification for selection
Strong influence of historic mining industry on both local culture and the landscape, in the form of ex-coal mining towns and villages with distinctive surrounding areas of allotments and pony paddocks, reclaimed colliery sites, disused and existing railways, industrial archaeology.	■ Many of the former colliery towns still have strong links to, and a fierce pride about, their mining past. An audit of the historic environment of the NCA for the Limestone Landscapes Partnership cites research which found that concepts of identity and home in East Durham are still inextricably linked with the coalfield[14]. ■ Although many of the structures and sites associated with the coal mining industry have been either removed or reclaimed, some features exist such as railways routes, either still used, such as the coastal railway, or disused and transformed for use as footpaths and cycleways. While the impact of railways associated with mining is largely positive from the perspective of landscape and recreation, and has served to protect the coast from development, the coastal railway can serve as a visual, psychological and physical barrier to the coast, and also create long and unpleasant access routes to the coast. ■ Many of the reclaimed colliery sites are now nature reserves, such as those at Horden and Ferryhill, which are well visited and highly valued by local residents. ■ A negative legacy of the coal mining industry along the coast was the dumping of large volumes of colliery waste into the sea. Until the Second World War the sea removed this waste from the beaches and equilibrium was achieved, but with increased mechanisation and output following this, the waste started to build up, eventually creating false beaches of coal waste 10 m deep in places. The Turning the Tide project has now successfully removed the waste from long stretches of the coast and restored beaches and coastal habitats.
Widespread urban and industrial development in the north and major transport corridors throughout.	■ The A19 runs right across the length of the NCA, and a short section of the A1 (M) can be found in the south-west corner. ■ The railway runs the length of the NCA near the coast and cuts across the northern section and south-west corner. ■ The main settlements in the NCA include Sunderland, Hartlepool (north), South Shields (south), Houghton-le-Spring, Peterlee, Newton Aycliffe, Seaham and Hetton-le-Hole. ■ Other areas, particularly near the coast, have scattered mining towns and villages with a distinctive urban character despite their rural location.

[14] *Limestone Landscapes Historic Environment Audit and Action Plan,* Archaeo-Environment Ltd for the Limestone Landscapes Partnership (2009; URL: www.limestonelandscapes.info/Pages/publications.aspx)

Landscape attribute	Justification for selection
A productive farmed landscape with a high proportion of large arable fields and some pasture for sheep and cattle grazing.	■ In 2009, 52 per cent of farmland was under arable production, and 45 per cent of holdings were classified as primarily cereal or general cropping. 57 per cent of the NCA is classed as farmland.
Small, fragmented patches of limestone grassland supporting unique combinations of plant and invertebrate species.	■ Many of the Magnesian Limestone grassland sites are designated as SSSI. The importance of two of the sites (Cassop Vale and Thrislington) is also recognised through their designation as National Nature Reserves. ■ 504 ha of lowland calcareous grassland.
Rich in important geological sites that are particularly valuable and informative for their range of well-preserved Permian fossils and illustration of geological processes.	■ The NCA has 11 geological SSSI, 7 mixed biological and geological SSSI and a number of locally important geological sites. ■ The area's Marl Slate has yielded a valuable fossil record; Middridge Quarry is Britain's best site for Permian plant and reptile fossils, including the earliest British ginkgo tree, and well-preserved fish fossils.

Landscape opportunities

- Protect and enhance limestone grassland sites through active grazing management, preventing scrub encroachment and by buffering and extending existing sites.
- Extend coastal habitats back from the sea cliffs to enable their survival as the cliffs erode.
- Ensure any new tree/woodland planting is in keeping with existing landscape character and sympathetic to sites of existing wildlife interest by using locally appropriate native trees, confining planting to areas away from limestone grassland sites and open areas on the plateau, choosing sites which will connect existing fragments of ancient woodland or buffer sites such as wooded coastal denes.
- Protect and retain existing semi-natural woodland and mature/ancient trees, particularly where these form part of distinctive landscape features such as coastal denes, river valleys and designed parklands.
- Maintain visibility of remaining archaeology by retaining grassland cover and avoiding new cultivation of earthworks, scrub encroachment onto sites or tree planting.
- Ensure appropriate maintenance of traditional buildings, using traditional techniques and materials, to avoid dereliction or unsympathetic alterations.
- Enhance the management and planting of reclaimed colliery sites to optimise their wildlife, amenity and landscape value, by using locally appropriate native species, by creating a range of suitable habitats, particularly Magnesian Limestone grassland, and by providing opportunities for safe and easy to use access routes for a range of users.
- Encourage the restoration of neglected and relict hedgerows (through measures such as gapping-up, coppicing and laying); establishment and planting of hedgerow trees; protection of existing mature hedgerow trees; and enhanced management of existing hedges through less-frequent cutting to allow flowering and fruiting.
- Ensure that landscape sensitivity is considered when decisions are made about installation of new wind turbines and creation of new development/ transport links, and measures taken to minimise landscape impacts, such as screening with suitable tree-planting, particularly where this can also produce biomass for energy generation.
- Enhance provision of green infrastructure and easily accessible green space as part of new development, and use sustainable design features where possible to help adaptation to climate change (such as permeable surfacing and strategic tree planting).
- Protect and record archaeological sites and enhance provision of interpretation information, particularly in relation to the coal mining industry and deserted medieval villages.
- Protect and enhance beaches, particularly using measures to prevent/remove litter such as improved litter disposal facilities and organised beach cleans.

Ecosystem service analysis

The following section shows the analysis used to determine key ecosystem service opportunities within the area. These opportunities have been combined with the analysis of landscape opportunities to create Statements of Environmental Opportunity.

Please note that the following analysis is based upon available data and current understanding of ecosystem services. It does not represent a comprehensive local assessment. Quality and quantity of data for each service is variable locally and many of the services listed are not yet fully researched or understood. Therefore the analysis and opportunities may change upon publication of further evidence and better understanding of the inter-relationship between services at a local level.

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Food provision	Soils Semi-natural habitats Ground water and water courses Sea	72 per cent of the soils in the NCA are Grade 3. In 2009 the NCA had 10,650 ha of cereals (41 per cent of agricultural land), 2,489 ha of oilseeds (10 per cent), 11,423 ha of grassland and uncropped land (44 per cent). It also had 39,920 cattle (50,764 in 2000), 104,162 sheep (158,672 in 2000) and 38,282 pigs (65,632 in 2000). **Continued on next page...**	Regional	The area produces good arable yields and provides good grazing pasture for cattle and sheep. Sustainable intensification of arable land is increasingly important to maximise food production while optimising environmental impacts. Techniques that could be particularly important for this area to increase levels of food provision and protect the environment include: yield and input mapping, minimum tillage and Integrated crop management (particularly use of biological rather than chemical pest control).	Encourage sustainable intensification of arable land that protects and enhances the local environment (particularly its soil quality, water quality and wildlife), using precision farming, other new technology / techniques and good farming practice. Encourage meat production from low intensity grazing of Magnesian Limestone grassland.	**Food provision** **Biodiversity** **Regulating soil erosion** **Regulating soil quality** **Regulating water quality** **Regulating water flow** **Genetic diversity** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Food provision cont.		**... continued from previous page** In 2005 Seaham still had a small commercial fishing fleet of small boats that may fish up to 6 miles off shore, primarily for crab, lobster and salmon in summer. The fishing fleet in Sunderland declined by 55 per cent from 2001 to 2003.[15, 16] There are large numbers of actively managed allotments around ex-mining towns that still serve an important role within local food production, with a large number of allotments available and actively used compared to the size of local populations.		Improvement of soil quality, structure and organic content could have benefits for agricultural productivity and resilience to prolonged period of drought or heavy rainfall resulting from climate change. The area has historically been important for commercial sea-fishing. Sunderland, Seaham and Hartlepool were the main landing harbours and commercial inshore fishery activity focused on trawling and potting operations for demersal species (such as plaice and cod) and crustaceans (such as lobster and crab), as well as seasonal drift netting for salmon and sea trout. The fishing industry in the area has been in decline since the 1980s/90s, partly as a result of collapses in North Sea fish stocks. The NCA has a strong history of subsistence food production from allotments, particularly around mining settlements. This continues today with many sites also having pigeon lofts and pony/livestock paddocks.	Encourage continued use of allotments by local people and seek to retain this resource in and around local communities for the benefits it brings to health and well-being.	

[15] *Durham Heritage Coast Management Plan 2005–2010,* Durham Heritage Coast Partnership (2005)
[16] *Regional Study: The Fishing Industry in North East England,* Seafish (1990)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Timber provision	Soils Existing woodlands	In 2011 there were 2,297 ha broadleaved woodland, 472 ha coniferous woodland, 4 ha mixed woodland, covering 7.5 per cent of the area. Also 279 ha shrub/ young trees and 42 ha felled/land prepared for planting. The area has 2 sawmills.	Local	There is little timber produced from the NCA and there is little potential for its expansion as it is mainly comprised of urban areas and productive arable land, with small patches of biologically important grassland habitats and nature reserves. The local landscape is highly sensitive to new tree planting, particularly of conifers. Where new woodland is created, broadleaved woodland made up of locally appropriate native species is preferable for the greater biodiversity, landscape and recreational benefits it provides. Woodland creation should be focused where it will be appropriate in the landscape (primarily denes) and where it will buffer or connect existing semi-natural woodland. Care should be taken not to plant woodland where it will pose a threat to other valuable habitats – such as around small Magnesian Limestone grassland sites which are vulnerable to scrub encroachment, or where it might increase the risk of introducing invasive species or diseases to existing woodland. New woodland should not be planted where it would be more appropriate to create a priority habitat, in particular Magnesian Limestone grassland.	Ensure that new woodland planting is appropriate with regard to location, species composition, enhancement of existing woodland, risk of increased transmission of pests/diseases and potential threat to existing priority habitats (especially Magnesian Limestone grassland).	**Timber provision** **Food provision** **Biodiversity** **Regulating soil erosion** **Regulating water quality** **Regulating water flow** **Genetic diversity** **Regulating soil quality** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability	Water courses Magnesian Limestone aquifer	The water resource availability status of the River Skerne is currently "water available at low flows", with a target status for 2014 of "no water available"[17]. The lower stretches of the River Wear are classified as "water available at low flow", with a target of moving to "water available" in 2014[18]. The Magnesian Limestone Groundwater Management Unit is classified as "water available", but the true availability of water is variable across the catchment, with water yields low in specific areas such as Newton Aycliffe.[19]	Regional	The Magnesian Limestone aquifer is significant in terms of its size and its supply of drinking water to Hartlepool. Monitoring of the aquifer has shown elevated levels of sulphate, chloride, sodium and nitrate in recent years, thought to be as a result of effluent from disused mine workings, abstraction and saline intrusion[20]. Management of agricultural land in the area could influence recharge of the aquifer. Measures to promote good soil structure, and reduce speed of surface run-off, could increase rain infiltration rates, thereby optimising groundwater recharge. These measures are also likely to improve water retention in soils, and therefore increase drought resilience.	Encourage good soil management to promote good soil structure and optimise infiltration of rain water into the aquifer. Expand areas of permanent grassland and semi-natural habitats to provide improved infiltration.	**Water availability** **Soil quality regulation** **Regulating soil erosion** **Regulating water quality** **Biodiversity**

[17] *The Tees Catchment Abstraction Management Strategy,* Environment Agency (2008; URL: http://cdn.environment-agency.gov.uk/gene0308bnte-e-e.pdf)
[18] *The Wear Catchment Abstraction Management Strategy,* Environment Agency (2006; URL: http://cdn.environment-agency.gov.uk/gene0906blha-e-e.pdf)
[19] *Groundwater Quality Review: Skerne Magnesian Limestone*, Environment Agency (2008)
[20] *Limestone Landscapes – a geodiversity audit and action plan for the Durham Magnesian Plateau*, British Geological Survey Open Report OR/09/007, DJD Lawrence (2009)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Genetic diversity	Semi-natural habitats Traditional breeds and varieties Species of plants and invertebrates	The Shorthorn cattle breed originated from the border between this NCA and the Tees Lowlands in 18th century.	Regional	No data is available on the size of populations of traditional breeds in the area at the time of writing. Traditional breeds can play a useful role in grazing conservation sites, particularly in terms of hardy native breed cattle to help control scrub encroachment on valuable grassland sites.	Encourage use of traditional breed cattle, especially the local beef Shorthorn, for grazing of under-managed limestone grassland sites.	**Genetic diversity** **Sense of place / inspiration** **Biodiversity** **Food production**
Biomass energy	Soils Existing woodland	Low predicted yield for miscanthus, medium for short rotation coppice[21]. Limited existing woodland to provide wood-fuel.	Local	There is potential to produce miscanthus on flatter land where arable predominates, but it has a low predicted yield except for a small, low-lying part of the south-eastern corner. Short rotation coppice has a medium yield potential generally, but its appropriateness would be limited to the urban fringe and areas needing restoration. Its use in the south-west of the area, where its yield potential is highest, is likely to be hindered in parts by the steepness of slopes and by the priority for recreation of Magnesian Limestone grassland. Both crops could have potentially adverse impacts on landscape (where they break up an otherwise open landscape), and biodiversity (if they replaced semi-natural habitat such as grassland), but can also be helpful in assimilating new development.	Encourage the establishment of biomass crops in suitable situations, in particular short rotation coppice, on areas in need of restoration or development in need of screening, where it will be close to transport links and will not have adverse impacts on landscape, archaeology, access or biodiversity. Improve/initiate management of existing woodlands to produce wood fuel for local use, where this will not undermine the nature conservation value of the woodland.	**Biomass energy** **Climate regulation**

[21] *Opportunities and optimum sitings for energy crops,* Natural England (November 2010; URL: www.naturalengland.org.uk/ourwork/farming/funding/ecs/sitings/areas/015.aspx)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation	Soils Woodland	The NCA has limited potential to help with mitigation of climate change, although it has more potential to help with local adaptation to a changing climate.	Local	The potential of the area to contribute towards climate regulation through sequestration and storage of carbon is limited. Organic carbon levels in the freely draining and intensively farmed soils of the NCA are relatively low. Larger stores of carbon will exist in grassland soils, but these may still be relatively limited. Releases of greenhouse gasses from land management activities (especially nitrous oxide from soils, and emissions from farm machinery) are likely to be relatively high and could be reduced through techniques such as minimum tillage agriculture, combination machinery to reduce vehicle passes over fields, use of green manure and cover crops. Such techniques could also improve soil structure and organic matter, thereby increasing resilience to climate change (particularly in terms of drought or waterlogging). The low woodland cover is likely to contribute relatively little to carbon storage, as will the remaining rather gappy hedgerows largely devoid of hedgerow trees. Low-carbon energy generation currently takes place in the area, primarily in the form of on and off-shore wind turbines, with strong links between Hartlepool and off-shore wind energy generation through manufacture and servicing of infrastructure.	Explore opportunities to enhance the natural environment to help regulate the impacts of climate change, for example tree planting in appropriate places to create shade or minimise adverse impacts associated with increased rainfall events. Encourage use of tree-planting, sustainable drainage, rainwater harvesting, creation of green space and other climate change adaptation measures in urban areas. Encourage farming practices that minimise greenhouse gas emissions from agriculture and increase organic matter content of agricultural soils to improve carbon storage.	**Climate regulation** **Biodiversity** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	Magnesian Limestone aquifer Soils Soil micro-organisms Semi-natural vegetation	Surface waters throughout most of the area are of moderate ecological quality, with some river stretches considered to be of poor ecological quality (such as the Castle Eden Burn). For water bodies in the Wear catchment as a whole in 2009, the Environment Agency classified them as follows: 24 per cent good ecological status or potential, 22 per cent good or high biological status, 75 per cent good chemical status, and 24 per cent good status overall (ecological and chemical)[22]. The water quality of the Magnesian Limestone aquifer is currently classified as poor, but with an upward chemical trend. It has raised sulphate levels and fails the "drinking water protected area" test[23, 24].	Regional	The limestone geology, and overlying soil (and associated micro-organisms), have potentially powerful roles in filtering and purifying water destined for the underlying aquifer. However, threats to the quality of both ground and surface water include pollution from disused mines into ground and river water; run-off and leachate of nutrients and chemicals from agriculture into river water; abstraction related saline intrusion into the aquifer; And groundwater pollution from historic and operational land fill sites[24, 25, 26] Water levels in the Coal Measures are currently pumped by the Coal Authority at Horden and Dawdon to prevent surface discharge in the west of the Wear catchment but principally to prevent contamination of the Magnesian Limestone aquifer which overlays the Coal Measures. The principle treatment sites are now at Dawdon and Horden. Water quality along the coast is generally good, having improved in recent years due to considerable efforts to remove industrial waste and improve treatment of sewage waste along the coast, improvement of water quality in the River Tyne to the north and removal of large volumes of colliery waste. In 2012 only Seaham Beach was reported as failing the Bathing Water Directive in 2012, with all other sample points along this coast meeting the Directive's mandatory standards[27].	Continue protection of groundwater by pumping of polluted water from old mines. Explore opportunities to reduce threats to water quality from disused mines upstream. Careful consideration of threats to groundwater when creating new landfill sites/ managing existing sites. Encouraging good practice, and appropriate agri-environment options, on farms to minimise diffuse pollution, such as buffer strips along watercourses and establishment of permanent grassland on ground at high risk of soil erosion.	**Regulating water quality** **Biodiversity**

[22] *River Basin Management Plan: Northumbria River Basin District,* Environment Agency (2009) [23] **http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=450500.0&y=532500.0&topic=wfd_groundwaters&ep=query&scale=7&location=Hartlepool, per cent20Hartlepool&lang=_e&layerGroups=1&distance=5&textonly=off** (accessed December 2012) [24] *Durham Landscape Strategy*, Durham County Council (2008) [25] *Groundwater Quality Review: Skerne Magnesian Limestone*, Environment Agency (2004) [26] *Shoreline Management Plan 2: River Tyne to Flamborough Head*, North East Coastal Authorities Group (2007) [27] Environment Agency bathing water quality data, accessed December 2012

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow	Soil Geology Semi-natural habitat	The risk of flooding in the catchment is currently low. There are no significant areas at risk of flooding from the major rivers within the NCA, although the Skerne is susceptible to flooding downstream in Stockton-on-Tees (outside the NCA), as is Lumley Park Burn as it passes through Houghton-le-Spring in the north. Areas at risk from flooding from a number of smaller tributaries/water courses include Seaham, Horden, Peterlee, Wheatley Hill and Hetton-le-Hole. There have been a small number of significant localised flooding events in recent years. The Wear Catchment Flood Management Plan regards the coastal streams areas as of low risk of flooding (with no reported flooding of properties currently). In the Tidal River Wear area there is a risk of flooding when high tides and high river flows coincide, particularly at Fatfield, and Environment Agency models suggest this area currently has 473 properties at risk of flooding[28].	Regional	Flooding could become a bigger issue in the area under a changing climate. If this is the case a number of measures could help to ameliorate flooding, such as management techniques that promote good structure of agricultural soils, increased cover of grassland where appropriate (to aid infiltration and slow run-off) and the use of permeable / planted surfaces and sustainable drainage systems in urban areas, especially when planning new development.	Promote good management of agricultural soils to optimise infiltration of rainwater and reduce rates of run-off at peak flow levels. Promote the use of sustainable drainage systems and permeable ground finishes in urban areas and in new development, enhancing green infrastructure where possible.	**Regulating water flow** **Biodiversity** **Food production**

[28] *Wear Catchment Flood Management Plan,* Environment Agency (2009)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil quality	Geology Soils Semi-natural vegetation Soil flora and fauna Topography	72 per cent of the land is classified as Agricultural Grade 3. Over half the farmland in the area is used for arable production. The slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (60 per cent) and the slowly permeable seasonally wet acid loamy and clayey soils (11 per cent) may suffer compaction and/ or capping as they are easily damaged when wet. The slightly acid loamy and clayey soils with impeded drainage (12 per cent) have a weak topsoil structure that can easily be poached by livestock and compacted by machinery when wet.	Local	Compaction or capping of agricultural soils may lead to increasingly poor water infiltration and diffuse pollution as a result of surface water run-off. The high proportion of land under arable production in the NCA puts the soils at high risk of compaction, capping, reduction in organic matter and decline in soil flora and fauna. However much of this risk can be minimised through good farming practice and adoption of agri-environment options which help to maintain soil structure, organic matter and soil flora and fauna. Soil organic matter can be improved through measures such as incorporating compost/manure/straw and use of green manures or winter cover crops. Soil structure also benefits from increased organic matter, and can be further protected and improved through measures such as minimum tillage techniques, aeration and avoiding using machinery on fields during very wet conditions (where possible). Livestock also pose a risk to soil quality in terms of poaching and compaction, particularly on wet ground. Again, good farming practice can help to reduce these risks. Protecting and enhancing soil quality, particularly in terms of organic matter content, will help optimise resilience to climate change, particularly in terms of long periods of either low or excessive rainfall. Drought resilience will be particularly important for crops and grassland on thin soils on the top of the limestone plateau, which are very vulnerable to drought damage.	Encourage adoption of farm management practices and agri-environment options that maintain good soil structure and high organic matter content, such as minimum tillage techniques, best practice in timing and use of machinery, incorporation of manure / compost /straw and use of green manure /cover crops.	**Regulating soil quality** **Regulating soil erosion** **Regulating water quality** **Regulating water flow** **Food production** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil erosion	Semi-natural habitats Soils	The slowly permeable seasonally wet soils that dominate this NCA (71 per cent) are at low risk of soil erosion. The slightly acid loamy and clayey soils with impeded drainage (12 per cent) are easily compacted by machinery or livestock if accessed when wet and are prone to capping or slaking, increasing the risks of soil erosion by surface water run-off, especially on steeper slopes. The freely draining slightly acid loamy soils (7 per cent) can erode easily on steep slopes, especially where vegetation is removed, soils are compacted or where organic matter levels are low after continuous cultivation. There is the potential for wind erosion on some coarse textured, cultivated variants. The lighter textured (less clayey) variants of the freely draining lime-rich loamy soils (8 per cent) are similarly at risk. There is little evidence to suggest serious problems with soil erosion in the NCA, because the majority of the land away from the escarpment and the coast is relatively flat and has few major water courses.	Local	There is little evidence that siltation is a significant issue in the middle and lower stretches of the River Wear,[29] suggesting either that there are low levels of soil erosion in the NCA and/or there is little erosion of banks along the river and its tributaries.	Encourage adoption of farm management practices, and agri-environment options, that minimise soil erosion risk. In cases of severe soil erosion, encourage conversion to practices such as spring (rather than winter) cropping, minimum tillage techniques and reversion of arable land to grassland.	**Regulating soil erosion** **Regulating water quality** **Regulating water flow** **Regulating soil quality** **Food production** **Biodiversity**

[29] *River Wear Salmon Action Plan Review,* Environment Agency (2008)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pollination	Semi-natural habitats (limestone grassland) Pollinator species	The fragments of flower-rich grassland, and the hedgerow network, alongside arable land suggest that pollination will be an important service in this area, but evidence is lacking.	Local	Pollination from native bee species (and other invertebrates) is likely to be important for crops, particularly beans and oil seed rape. Creation of more flower-rich habitats could help to support and possibly increase populations of pollinator insects, and bring other benefits for wider biodiversity.	Expand areas of flower-rich habitats, particularly Magnesian Limestone grassland, to provide additional nectar sources for pollinating insects. Encourage creation of flower-rich grassland strips within arable land, alongside hedges, watercourses and on headlands to create food/habitat for pollinators, wildlife corridors and habitat networks.	**Pollination** **Food production** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pest regulation	Semi-natural habitats Beneficial predator species	The fragments of flower-rich grassland, and the hedgerow network, alongside arable land suggests that pest regulation may be provided by the ecosystem in this area, but evidence is lacking, both for this NCA and on the service more generally.		There is some evidence to suggest that certain habitats such as hedges, flower-rich buffer strips and unimproved grassland can support populations of beneficial predator species which can help control common agricultural pests, for example ladybirds and aphids[30]. Habitats which provide a nectar source, shelter and additional prey species all have the potential to increase beneficial predator numbers. Studies suggest that hedgerows cut every year have less value for invertebrates, so less frequent cutting of hedges in this area, while not necessarily in keeping with existing character, could help support higher numbers of beneficial predators and many other species. Where pest regulation services are provided by semi-natural habitats and associated species, this could reduce the need for pesticides, thereby affording benefits for water quality, soil quality and wider biodiversity. If the approach could be perfected for this area, to maximise the agronomic benefits, it could play a valuable role in terms of increasing production of arable crops while reducing negative impacts on the environment.	Seek opportunities to restore/expand areas of flower-rich grassland, particularly Magnesian Limestone grassland. Encourage uptake of suitable agri-environment options, for example, hedgerow management, buffer strips, pollen and nectar mix, next to arable fields.	**Pest regulation** **Food production** **Regulating soil quality** **Regulating water quality**

[30] *Ecosystem Services from Environmental Stewardship that benefit agricultural production,* Natural England (2012)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating coastal flooding and erosion	Geology Soils Topography	In general the erosion of the coastline along this NCA is slow compared with other parts of the English coastline, approx 0.3 – 0.5 metres per year. The colliery waste on some beaches will have slowed coastal erosion further by protecting the coast and cliffs, but stretches of the coast that have been cleared are now likely to be eroding again.[31, 32] Natural topography of bays and headlands limit longshore transport of sediment. The River Tyne to Flamborough Head Shoreline Management Plan identified that along parts of the Sunderland Coast there are issues of coastal erosion and coastal squeeze.	Local	Coastal squeeze is a threat to some of the valuable habitats and access routes along the coast. There are opportunities to create new areas of priority habitat (particularly Magnesian Limestone grassland) to extend their reach back from the coast, and to move access routes back. The possibility of such work will depend upon the willingness and active engagement of landowners, and habitat creation might not be feasible in all circumstances, for example, where soil has high fertility levels due to years of fertiliser application. Coastal erosion rates are perceived to be higher in recent years on some sections of coast, due to the removal of colliery spoil and high rainfall in 2012, meaning that habitat loss rates may be exceeding not only actual habitat creation rates, but also potential habitat creation rates using current methods. Novel approaches may need to be explored, such as moving topsoil (and therefore seed bank) from small areas of cliff edge sites to land further away from the erosion edge. **Continued on next page...**	Extend priority coastal habitats, particularly Magnesian Limestone grassland, and access routes back to ensure they are not lost to coastal erosion. Explore novel approaches to speed Magnesian Limestone grassland creation, so that habitat can be extended faster than it is lost through coastal erosion.	**Regulating coastal erosion and flooding**

[31] *Shoreline Management Plan 2: River Tyne to Flamborough Head,* North East Coastal Authorities Group (2007)
[32] *River Tyne to Flamborough Shoreline Management Plan,* Appendix C: Baseline Process Understanding, Royal Haskoning (2007)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating coastal flooding and erosion cont.				**...continued from previous page** There are potential pollution issues associated with the erosion of coastal landfill sites. The large volumes of colliery waste dumped off the coast and washed up on beaches, provided a large defensive shelf which temporarily protected the cliffs from erosion. The removal of this waste (through human intervention and natural erosion) should see erosion rates return to their previous levels. In some areas the large coastal shelves formed by colliery waste have led to "disequilibrium", and the coast is now actively trying to adjust to a state of equilibrium.[33]		

[33] *The Wear Catchment Abstraction Management Strategy, Environment Agency (2006; URL:* **http://cdn.environment-agency.gov.uk/gene0906blha-e-e.pdf***)*

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
A sense of place/ inspiration	Semi-natural habitats (esp. Magnesian Limestone grassland) Topography Coast Watercourses Geology	The area has an exceptionally strong sense of place. The history of coal mining in the area plays a pivotal role in sense of place. The coast, coastal denes and Magnesian Limestone flora all make a strong contribution to the character of the area.	Local	There is a very keenly felt sense of identity among local residents, particularly those from former coal mining communities. The coast is a very strong source of inspiration, not just for the impressive vistas along the coast and out to sea, or the distinctive coastal plants and wildlife, but also for its powerful story of environmental restoration: the removal of more than 1 million tonnes of colliery waste from the coast. This has transformed the views along the coast and the quality of the environment for coastal and marine species. The same could be said of the River Wear – which was named by the Environment Agency as one of the most improved rivers in England and Wales in 2011. Distinctive habitats, particularly the Magnesian Limestone grassland and coastal denes, contribute to the sense of place.	Seek opportunities to promote the unique qualities of the area to people outside the NCA, and encourage sustainable forms of tourism. Protect, manage, extend, buffer and link priority habitats (where appropriate), particularly the denes and Magnesian Limestone grasslands. Seek opportunities to improve provision of information about ex-mining sites, and to celebrate local history and culture. Maintain and improve access to the coast and to views up and down coast.	**Sense of place / inspiration** **Sense of history** **Biodiversity** **Geodiversity** **Recreation**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	Archaeology (particularly industrial) Geology Fossil record	30 scheduled monuments 38 conservation areas 7 registered parks and gardens (314 ha) 639 listed buildings Important industrial archaeology. There is a high concentration of prehistoric barrows and cairns on the plateau, some of which have been well-preserved under grassland. The area also has a large number of deserted medieval villages (such as Garmondsway), extensive areas of ridge and furrow (ranging from medieval ox-ploughed, to Victorian steam ploughed) and many 18th and 19th century planned farmsteads.	National	Fossils, geological exposures and dramatic glacial features (such as the coastal denes) give a sense of history on a geological timescale. The industrial archaeology of the area is particularly striking. Traces remain of many industrial transport routes associated with mines and quarries: railways, tram lines and inclines. Abandoned quarries and mines are still visible in some areas (although many have been reclaimed and are now concealed by tree planting and other restored vegetation), along with associated dramatic industrial buildings such as Elemore Pithead Baths. Some colliery sites lack obvious context since mining infrastructure has been removed and these would benefit from interpretation material. The coal mining history is also embodied in the culture and pride of people in the area. Information about heritage of the area is given at museums (in adjacent NCAs) and a few key sites, but information provision could be strengthened. **Continued on next page...**	Seek opportunities to improve public access to and interpretation of important historic sites where appropriate. Seek opportunities to get archaeological earthworks taken out of cultivation, particularly where reversion to grassland could also have benefits for water quality, soil erosion and biodiversity. Protect and maintain buildings of historic importance and encourage use of traditional materials and techniques. Support training in traditional building techniques. Manage and restore designed parklands.	**Sense of history** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history cont.				**... continued from previous page** Well-visited historic sites within the area include 18th and 19th century designed landscapes and parkland such as Castle Eden and Hawthorn Dene. There are also a number of publicised walking routes designed around historic themes, such as The Bede Way Walk and Cycleway, The Stephenson Trail and The Coalfield Way. There is a perceived lack of public access to some important historic sites such as Warden Law and Shackleton Beacon iron-age hill fort. The heritage audit produced for the Limestone Landscapes Partnership identifies 25 key sites which encapsulate the essential features of the historic environment of the East Durham Magnesian Limestone Character area".[34]		

[34] *Limestone Landscapes Historic Environment Audit and Action Plan, Archaeo-Environment Ltd for the Limestone Landscapes Partnership (2009; URL:* **www.limestonelandscapes.info/Pages/publications.aspx***)*

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Tranquillity	Semi-natural habitats Open spaces Denes Sea Coast	The 2006 CPRE 'Map of Tranquillity' gave the NCA a mean tranquillity score of -19. With the highest value being 31 and the lowest -91. The 2007 CPRE Intrusion Map rated 72 per cent of the NCA as "disturbed", 7 per cent "undisturbed" and 21 per cent "urban".	Local	The lowest scores for tranquillity in this NCA were associated with the urban areas of Sunderland, Seaham, Peterlee, Hartlepool, Ferryhill and Newton Aycliffe. The highest tranquillity scores were associated with the deep coastal denes and higher parts of the limestone plateau. While there are no big areas of undisturbed land, as in the Pennines to the west, there are small pockets of tranquil areas which are of immense value to the local community – particularly the coast, coastal denes, nature reserves, country parks and reclaimed colliery sites. Many of these sites are within easy travelling distance of urban areas, often connected by footpaths and cycleways, giving local residents many opportunities to experience (relative) tranquillity and making an important contribution to quality of life. New development should be carried out in such a way that it does not undermine the tranquillity of key areas, and also improves opportunities to access them.	Protect existing areas of high tranquillity from intrusion by new developments or transport infrastructure, and ensuring that where such development happens it is sympathetic and well-designed so as to minimise disturbance and intrusion. Promote access to and use of existing tranquil areas (particularly nature reserves and the coast) through a range of media and techniques.	**Tranquillity** **Sense of place / inspiration** **Recreation**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation	Semi-natural habitats Open spaces Access routes Sea Coast River Wear	The NCA has 1,864 ha of publicly accessible land and 661 km of public rights of way at a density of 1.4 km per sq km. It also has 154 ha of country parks, 337 ha of accessible National Trust land, 775 ha of Woods for People and 806 ha of nature reserves (local and national). The coast is particularly important for a range of activities including: sport fishing, bird watching, walking and water sports. Fly fishing is popular on the River Wear. It is reputed to be one of the most productive sea trout and salmon rivers in England, with the annual salmon catch increasing from 2 in 1965 to 1,531 in 2010. Bird watching is a popular activity, particularly along the coast.	Local	Local residents are the primary users of this NCA's recreational resources. Notable assets to the greenspace and rights of way network have arisen from conversion /reclamation of historic industrial sites and features, such as the many traffic-free cycle routes and footpaths along disused railways, and reclaimed quarries and colliery sites that are open to the public. Cycle routes within the area provide good links between centres of population and employment, and are used by many for commuting, thereby reducing car traffic at peak times and contributing to the health, well-being and finances of commuters. The final section of one of the Coast to Coast cycle routes passes through the NCA. Barriers in the local rights of way network include busy roads (especially A1(M), A19, A179, A689) and railway lines[35]. Improved crossing points would make a very valuable addition to the network. **Continued on next page...**	Seek opportunities to develop more/better access routes to the coast (particularly the sections designated as Heritage Coast) and more Local Nature Reserves near centres of population, while identifying ways to minimise disturbance to wildlife and damage to rare habitats. Enhance the rights of way network by finding solutions to key barriers such as foot/multi-user bridges over roads and railways. Seek opportunities to enhance provision of information about the wildlife, heritage and geology of the area, particularly the coast, to local residents and visitors from outside the area, drawing on the unique assets of the area that give it such strong sense of place (Magnesian Limestone grassland flora, coast, mining history, environmental restoration).	**Recreation** **Sense of place / inspiration** **Biodiversity**

[35] *Audit of Access and Greenspaces for the Durham Magnesian Limestone Plateau, Limestone Landscapes Partnership (2009)*

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation cont.				**...continued from previous page** The residents of the area have good access to greenspace and adequate access to local nature reserves. Access to large sites is limited throughout most of the NCA, with the notable exception of Herrington Country Park, which provides high quality greenspace easily accessible to residents of Sunderland[36]. Just outside the NCA, in The Tees Lowlands, Hardwick Country Park is also well-visited by residents of the NCA. The 4 National Nature Reserves in the NCA provide a valuable recreational resource, currently well-resourced to provide dedicated information and events. Castle Eden Dene and other coastal denes are particularly popular destinations. Many of the urban areas lack parks and gardens,[37] something that new developments should seek to remedy as far as possible. The coast is an excellent resource for access to an inspiring landscape and for land and sea-based recreation. Access to and along the coast has improved in 21st century in terms of both quantity (with new routes being created as part of the Turning the Tide and other local projects) and quality (with local projects improving ease of access to existing routes and providing additional interpretive material and guided walks/events). **Continued on next page...**	Encourage outdoor recreation for local residents, particularly for its health benefits, through events, publications, online resources and on-site interpretation. Explore opportunities to further enhance the water quality of the River Wear and facilitate migration of salmon and sea trout to enhance fishing opportunities. Plan for new development to incorporate green infrastructure and access opportunities, especially along the coast to help take recreational pressure off sensitive wildlife sites.	

[36] *Opportunities and optimum sitings for energy crops,* Natural England (November 2010; URL: www.naturalengland.org.uk/ourwork/farming/funding/ecs/sitings/areas/015.aspx)
[37] *County Durham Green Infrastructure Strategy,* Durham County Council (2012)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation cont.				**...continued from previous page** The entire coastline of this NCA will fall within one of the first stretches of the England Coast Path, with the original plan being to open the path by 2015. There are still some problems with coastal access such as lack of suitable parking, lack of public transport, lack of safe routes crossing the railway and anti-social behaviour in some places. It is likely that the number of people accessing the coast for recreation will increase in future and care should be taken to ensure that this does not undermine the tranquil nature of the coast and that increasing visitor numbers are managed to ensure no disturbance to sensitive parts of internationally designated wildlife sites, particularly bird nesting areas.		

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity	Semi-natural habitats (especially Magnesian Limestone grassland, dene woodland and coastal habitats) Plant and animal species Soils Geology Rivers and streams Coast	52 SSSI (933 ha), 4 NNRs (327 ha), 3 SAC (453 ha), 2 SPAs (40ha), 2 Ramsar sites. 132 Sites of Importance for Nature Conservation. Two thirds of the UK's Magnesian Limestone grassland is found in this NCA, and it is the only place in the world to support the CG8 vegetation community (blue moor grass/small scabious). The area's Magnesian Limestone grassland supports a range of UK priority species, and an unusual assemblage of species typical of both northern and southern UK habitats. The NCA is particularly important for rare arable flora and rare flowers of limestone grassland.	International	The distinctive flora and fauna of this area give it a strong sense of identity and have strong appeal to local people. These include: flowers such as bee orchid, dark red helleborine, bird's eye primrose and sea thrift; invertebrates such as the northern brown argus butterfly and glow worm; mammals such as water vole and otter; fish such as sea trout and salmon; and birds such as little tern, turnstone and grey partridge. Within the NCA there remain 'hot spots' for several species of important farmland bird species, including corn bunting, yellow wagtail and redshank. Bird-watching is a popular activity in the areas, as is sport fishing. Natural England specialists have identified this NCA as among the top 5 in England for frog orchid and purple milk-vetch. Most UK conservation designated sites in the NCA, and all European / International ones, are comprised of limestone grassland, coastal habitats and coastal denes. **Continued on next page...**	Encourage appropriate management of Magnesian Limestone grassland sites through agri-environment schemes, other funding and advice. Expand valuable coastal habitats inland to ensure they are not lost through coastal erosion. Create robust ecological networks by expanding and buffering areas of existing grasslands, woodlands and wetlands and creating links between them (corridors and stepping stones), where this will not increase the spread of diseases or invasive species. Protect coastal denes and respond quickly to threats from diseases and invasive species. Protect watercourses and manage banks and adjacent land for the benefit of water voles, otters, salmonids and general water quality.	**Biodiversity** **Sense of place / inspiration** **Recreation** **Pollination**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity cont.				**... continued from previous page** Specific threats to the biodiversity of this area include: neglect, and subsequent scrub encroachment, of Magnesian Limestone grassland; genetic isolation of species in fragmented habitats, particularly grassland; loss of coastal grassland through coastal erosion. Improved management of hedgerows could make a big contribution to supporting the overall biodiversity of the area. Less frequent trimming would allow hedges to provide much greater quantities of nectar for insects and fruit for birds and small mammals over winter. Managing hedges so that they become slightly taller and denser, would also enhance their value as wildlife corridors. The area has a low cover of woodland habitats, and some of the semi-natural woodlands that do occur are of exceptional conservation and landscape importance, particularly the coastal denes. The small size of areas of semi-natural habitats, and therefore strong edge effect upon them, could make them particularly prone to damage by invasive species and diseases. Particular care should be taken to monitor regularly for signs of invasive species or disease and respond quickly and thoroughly where they occur.	Enhance promotional and interpretive material about the unique and distinctive natural assets of the area to encourage visitors from outside the NCA and appreciation among local residents, managing any increase in visitor numbers to avoid damage to sensitive sites. Facilitate bird watching and observation of other wildlife through provision of information and suitable facilities such as bird hides and access routes. Encourage the sympathetic management of hedgerows at a landscape scale alongside less frequent cutting regimes, and the establishment of hedgerow trees, for the benefit of a range of bird, mammal, insect and plant species. Extend and buffer existing woodlands, particularly coastal denes, where this does not present a threat to archaeology, valuable habitats or landscape character. Encourage farmers to provide habitats/ areas in which farmland birds can breed and feed – such as fallow areas, grass buffer strips and wild bird seed plots. Protect important breeding and feeding grounds for birds along the coast.	

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	Geology Limestone escarpment Coast	Outstanding Permian fossil records have been found in marl slate deposits. The Magnesian Limestone, is made up of various layers, all of which lie above the Carboniferous coal measures. The NCA has 11 geological SSSI sites and a further 7 mixed geological sites. The coast has many important geological sites, recognised by designation of most of it as SSSI for geological and biological interest and recognition as Heritage Coast.	National	The area's geology has been the principle driver for the agricultural and mining industries, in terms of provision of ironstone, coal, lime and limestone. The character of this area is exceptionally strongly defined by its underlying geology, in terms of its cultural history, its vegetation (some named after the Magnesian Limestone) and even the name of the NCA. It has a number of dramatic exposures which illustrate geological processes, particularly at the coast, along the western escarpment and inland in the form of active and disused quarries, road and rail cuttings, river sections and natural outcrops. The Magnesian Limestone is of great importance as an educational and research resource. The outcrops are without parallel for their richly fossiliferous Permian reef exposed across the NCA with classic localities such as Tunstall Hills in Sunderland providing a cross-section from the core to the edge of the reef.	Preserve important geological sites, manage vegetation to retain their visibility and seek opportunities to enhance information provision and access to sites for the public. Maintain and interpret views of coastal features.	**Geodiversity** **Sense of place/ inspiration** **Sense of history**

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