



Introduction

As part of Natural England's responsibilities as set out in the Natural Environment White Paper¹, Biodiversity 2020² and the European Landscape Convention³, 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.

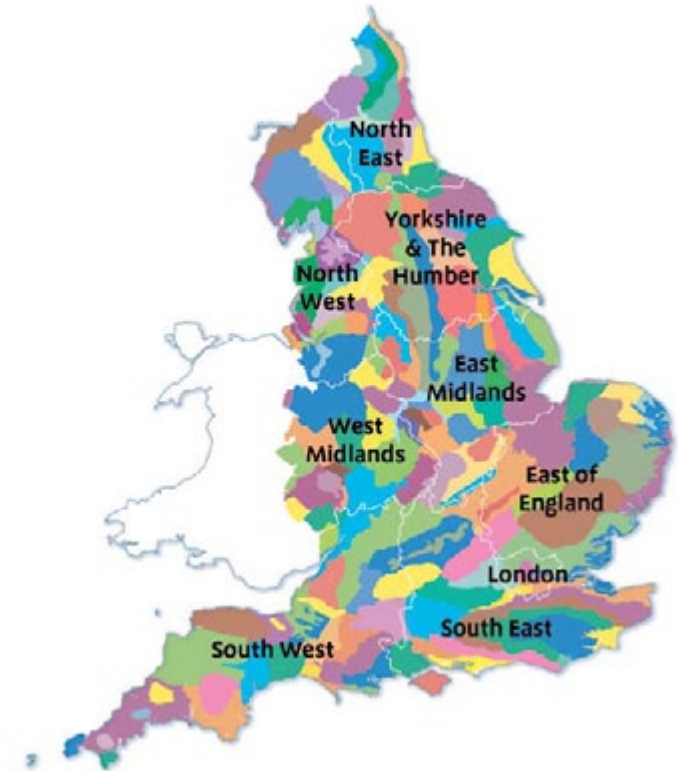
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and 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

Morecambe Bay Limestones National Character Area (NCA) is a lowland landscape arcing round the head of Morecambe Bay consisting of conspicuous limestone hills with prominent scars, cliffs, screes and exposed limestone pavements separated by areas of low-lying undulating farmland.

The margins of Morecambe Bay have been formed by faulted outcrops of Lower Carboniferous Limestone, forming upstanding blocks and bare limestone scars, pavements and cliffs. Lower-lying undulating pastoral areas are found between the hills and the coast, including a larger-scale rolling landscape to the west and a smaller-scale landscape that contrasts with the surrounding limestone hills to the east. The character of the landscape is shaped by underlying geology, with areas of flat open grazing marsh framed by dramatic limestone outcrops, extensive salt marshes and sand flats re-profiled by the tides, and intimate mosaics of limestone woodland and limestone grasslands. The dynamic landscape of the coastal fringe is dominated by the intertidal foreshore with extensive areas of mudflat, sand flat and salt marsh backed by low limestone cliffs, pebble beaches or manmade defences.

The NCA has frequent exposures of limestone pavement, in total covering 776 ha of the NCA, making up a significant proportion of the national and global resource. Almost a fifth of the NCA is designated Sites of Special Scientific Interest for its high-quality habitats and the species they support, including salt marshes, lowland raised bogs, limestone pavements, limestone grasslands, ancient woodlands, reedbeds, rivers and marl tarns. Sites of international importance include Morecambe Bay Pavements Special Area of Conservation (SAC) with its range of limestone plant communities and species, Witherslack

Mosses SAC with its lowland raised bog plant communities, the River Kent SAC with its white-clawed crayfish, Leighton Moss Special Protection Area (SPA) and Ramsar site with its bittern and other reedbed species and Morecambe Bay SAC, SPA and Ramsar site with its range of estuarine communities, notably salt marshes in the NCA, and its wintering wader and wildfowl population.

The NCA also holds important areas of coastal and flood plain grazing marsh, lowland meadows, historic parklands and orchards. The area includes Arnside and Silverdale Area of Outstanding Natural Beauty (AONB) and parts of the Lake District National Park and Forest of Bowland AONB. Over 15 per cent of the NCA is covered by woodland and this resource is continuous with the high-quality woodlands of the adjacent South Cumbria Low Fells NCA.

[Click map to enlarge; click again to reduce.](#)

The majority of the NCA is managed as pastoral agricultural land with beef and sheep rearing throughout with some dairy on the better grazing marshes and drumlin landscapes. Many woodlands are actively managed for timber and wood fuel. Throughout, the NCA has a very rural character with a scattering of small settlements and only a few larger villages and towns. Settlement patterns reflect a long tradition of deriving a living from the land, with the market towns restricted to the edges of the NCA. Field sizes tend to be small with drystone wall boundaries that reflect the local geology and hedges on deeper soils and reclaimed marshes, often flanked by ditches.

With the high cover of peat-based soils and woodlands, the NCA offers an important role supporting climate regulation while offering an important contribution, through wood fuel provision, in aligning a low carbon economy with maintenance of high-quality woodlands. The quality of the landscape in the National Park and AONB landscapes, when combined with good transport links to major conurbations, also affords an opportunity to develop an economy based on the natural environment as a tourism asset as well as a social and cultural asset for local communities.



High brown fritillary one of the many special species that benefit from woodland management.

Statements of Environmental Opportunity

- **SEO 1:** Protect and enhance the extensive mosaic of high-quality limestone habitats, including pavement, woodland, scrub and grassland, to create a coherent and resilient ecological network, retain a sense of place and maintain the strong relationship between the landscape and its underlying geology.
- **SEO 2:** Ensure the long-term sustainable management of the nationally and internationally designated coastal zone by conserving and managing its habitats, including the extensive sand flats, salt marshes, estuarine landscapes and limestone cliffs, for their wildlife, strong sense of place, inspiration and tranquillity, their diverse range of species, their traditional fisheries, and for their ability to mitigate the effects of climate change through carbon sequestration and coastal flood mitigation.
- **SEO 3:** Ensure the long-term sustainable management of the nationally and internationally designated wetland landscape and its linking, non-designated, habitats by conserving and restoring the lowland raised bogs, fens, rivers and reedbeds for their strong sense of inspiration and tranquillity, their diverse range of species, and for their ability to mitigate the effects of climate change through carbon sequestration.
- **SEO 4:** Conserve and enhance the wider landscape of the NCA as the supporting framework to its distinctive attributes, including features of the drumlin landscape, the settlement character, orchards, recreational identity and heritage features, for their individual importance and the complementary role they play in supporting the local visitor economy and providing enjoyment and education to visitors and residents alike.



Morecambe Bay's internationally important bird populations seek refuge at high tide at disturbance-free roost sites.

Description

Physical and functional links to other National Character Areas

Backed by the limestone geology at the head of Morecambe Bay, the open intertidal flats and salt marshes that fringe the Morecambe Bay Limestones National Character Area (NCA) extend across the adjacent West Cumbria Coastal Plain and Morecambe Coast and Lune Estuary NCAs. This forms a dynamic shared sediment system that supports the bay's natural resources.

The high woodland cover of the NCA extends into the South Cumbria Low Fells NCA. The woodland is mainly associated with steeper slopes and thinner soils, and there is a historic continuity of woodland management extending across the wider area. The drumlin field occupying the gaps between the limestone hills extends into the adjoining NCAs and under the sediment system of Morecambe Bay itself.

The rivers Kent and Leven flow from the adjacent South Cumbria Low Fells NCA and have catchments that reach far into the mountains of the Cumbria High Fells NCA. They discharge into Morecambe Bay through dynamic estuary systems. The smaller rivers such as the Winster, Bela and Keer, have less extensive catchments but wider areas of associated flood plain, which stretch into the South Cumbria Low Fells NCA. These smaller rivers lie predominantly within the Morecambe Bay Limestones NCA and flow into the channel of the River Kent as they enter the bay.

Views from within the NCA are largely framed by the surrounding upland landscapes, including the Cumbria High Fells, the Howgill Fells, the Yorkshire Dales and the Bowland Fells NCAs. From high points within all these upland NCAs,



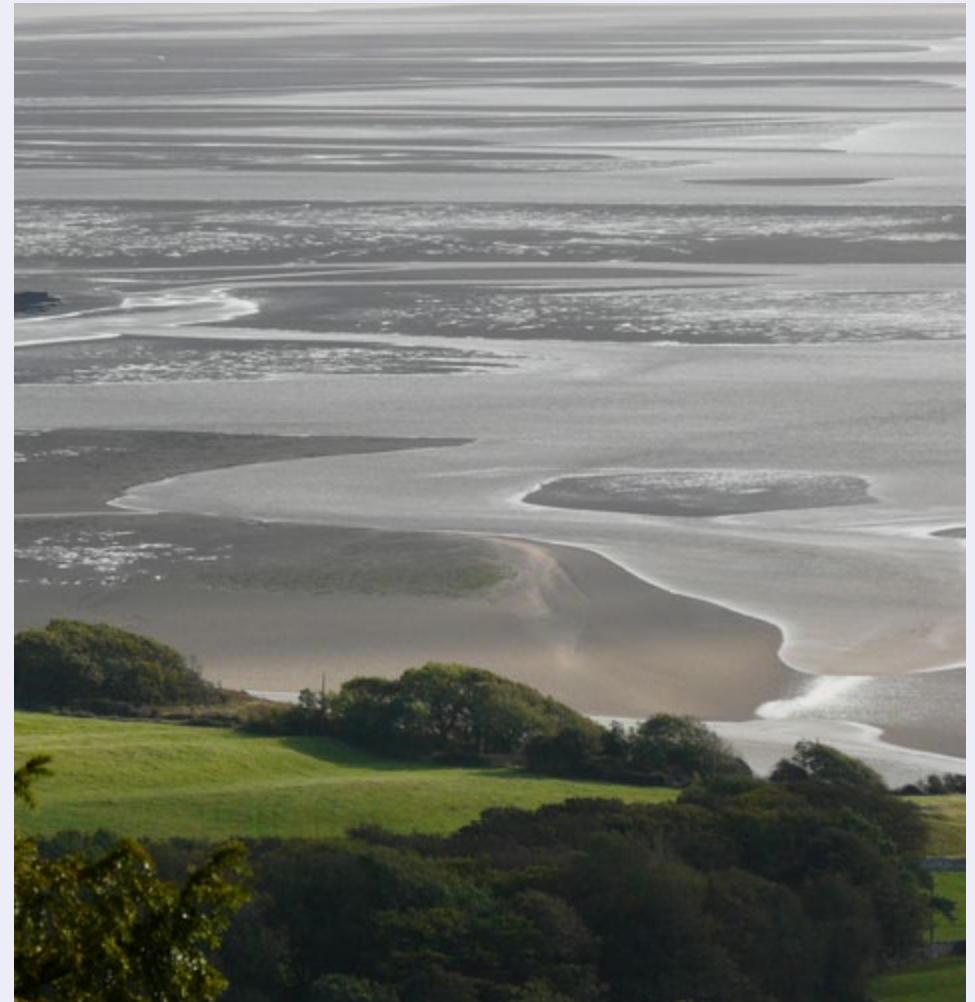
The River Kent is one of a number of rivers that cross the NCA to reach Morecambe Bay.

there are long, open views across the landscape of Morecambe Bay to its mouth in the Irish Sea.

The eastern part of the NCA is crossed by an ancient north–south aligned transport route linking the narrow corridor between Morecambe Bay and the Bowland Fells in the Morecambe Coast and Lune Estuary NCA, and the Lune Valley passage between the Cumbria High Fells and the Howgill Fells. The course of this route is traced today by the motorway and rail networks, and in part by the Lancaster Canal. Routes westwards through the NCA have been less fixed, varying over time with mode of transport but today both rail and trunk roads cross the NCA as the main access route to the town of Barrow-in-Furness and the southern parts of the West Cumbria Coastal Plain NCA.

Key characteristics

- A flat lowland landscape, dominated by conspicuous, often steep-sided, hills of Lower Carboniferous Limestone, many of which include exposures of limestone pavement. Between the hills the landform is geologically recent, including areas of drumlin field, fluvial and estuarine sediment and peat bogs.
- Wide expanses of shifting intertidal sand flats and expanses of salt marsh arcing round the head of Morecambe Bay, backed by low cliffs with windswept trees, or grassed embankments defending reclaimed grazing marshes.
- The rivers Kent and Leven enter Morecambe Bay via dynamic estuary systems. The smaller rivers Winster, Bela and Keer lie predominantly within this NCA and have relatively extensive flood plain areas before flowing into the channel of the River Kent as they enter Morecambe Bay.
- The limestones support a mixed pastoral farming and woodland landscape, often in tight mosaics, with orchards surrounding the farmsteads and fields bounded by limestone drystone walls.
- A winter climate ameliorated sea which, as well as the exposed south facing slopes of the limestone outcrops allows a number of temperature sensitive species to make this the northernmost fringe of their range.
- Strong contrasts between the rectilinear enclosures of reclaimed valley bottoms and coastal fringes, and the older enclosures associated with farmsteads and ancient woodland, bounded by limestone drystone walls, on the limestone escarpments.
- Extensive areas of native broadleaved woodland on limestone areas, particularly on the steeper slopes and thinnest soils.
- An abundance of high-quality semi-natural habitats of national and international importance, including limestone pavements, herb-rich



Views over the shifting sands of Morecambe Bay change with the light, tides and seasons.

grasslands with juniper, species-rich scrub, ancient limestone woodlands, peaty fenlands, marl tarns, reedbeds, lowland raised bogs, salt marshes and intertidal mud and sand flats.

- An exceptional range of species associated with the diverse range of semi-natural habitats, many with populations of national importance, including a suite of limestone butterflies, bittern, marsh tit and lady's-slipper orchid.
- Within the drumlin field to the south of Kendal, a gently undulating farmland of pastures and arable, divided by drystone walls made of field stone, with a limited cover of broadleaved woodland.
- Sheep and cattle graze the pastures and salt marshes, with rough grazing a feature of the higher grounds on unimproved limestone grassland.
- Extensive areas of reclaimed land on the coastal fringe and in the Lyth Valley have large fields bounded by ditch-flanked hedgerows. Lowland raised mires surrounding the limestone outcrops have been reclaimed for agriculture.
- Several stately homes set in parkland landscapes with well maintained gardens.
- A vernacular building style common to all settlements and farmsteads based on the use of local limestone for walls and Lake District slate.
- Settlements are generally dispersed and rural in character, having usually grown around large farmsteads. Larger centres include Grange-over-Sands, Arnside, Silverdale and Milnthorpe, some of which have a seaside resort character, reflecting the growth in the use of the area for recreation from the 18th century onwards.
- A range of visible heritage features including burial mounds, stone circles, prehistoric settlements and enclosures, medieval field patterns, the Lancaster Canal and Second World War airfields.
- An extensive rights of way network, particularly on areas of limestone geology, integrated with areas of permissive access land.



Dallam, one of a number of stately homes linked to the area's historically estate-owned landscape.

Morecambe Bay Limestones today

The character of the Morecambe Bay Limestones NCA is dominated by its limestone geology, evident in a series of limestone blocks which rise, island-like or as ridges, from a surrounding landscape of low-lying more recent geology. As a whole they form an arc rising steeply from the horizontal estuarine landscape at the head of Morecambe Bay with its extensive intertidal flats and salt marshes. Between these limestone hills, and to the south of Kendal, the landform is that of a drumlin field left by the retreat of glaciers from the last ice age, where smooth rounded hills support wet acid soils. The area includes a number of shallow river valleys including the Crake, the Lyth, Bela and Keer whose rivers join the channels of the main rivers, the Leven and the Kent, as they enter Morecambe Bay.

The different limestone blocks vary in character as determined by their height, topography and aspect. Throughout, they support mosaics of limestone habitats including extensive areas of woodland, pavement, scree and species-rich grassland divided by drystone walls of limestone. On some of the larger blocks such as Whitbarrow and Hutton Roof the different habitats are extensive and dispersed – screes and woodlands on steeper slopes, pavements and grasslands on the summit plateaux – in others they are tightly interwoven as in the Arnside and Silverdale Area of Outstanding Natural Beauty (AONB) where limestone woodlands, grasslands, pavements and wetlands are found in a tightly knit mosaic and where turning a corner can reveal a different landscape.

The woodlands are varied. In some areas ash dominates as high forest but elsewhere the woodland is more open with areas managed as coppice. Scattered across the woodlands are ancient stands of yew, often growing



The raised bogs of the coastal plain sit in contrast to their surrounding reclaimed farmland.

directly from the surface of the limestone. Elsewhere, where the thin soils of the woodlands grade into the open, there are areas of species-rich grassland, grazed wood pasture and species-rich scrub. Where soils are absent, areas of limestone pavement are exposed, sometimes as outcrops among grasslands but frequently beneath woodland. Although the limestones largely lack open water, rare marl lakes can be found at Hawes Water and Cunswick Tarn. As a whole, these limestones support a number of nationally rare species, many at the northern limits of their range, including suites of woodland butterflies, birds and plants, including the endemic Lancastrian whitebeam.

Fringing Morecambe Bay, the low limestone cliffs with their grasslands and wind-sculpted trees give way abruptly to extensive areas of salt marsh and

intertidal flats. The shifting patterns of light and colour playing across the bay's surface combine with the ebb and flow of the tide to constantly change the bay's character. The continual meandering of the tidal channels of the rivers Kent and Leven result in significant changes to the pattern and equilibrium of salt marsh and sands, shifting the boundary between land and sea. The marshes are grazed and the sight of sheep and cattle on intertidal areas has been a characteristic feature of the area for centuries. This creates ideal conditions for breeding waders and wintering waders and wildfowl which provide interest throughout the year.

Between the limestone hills, the low-lying valleys and reclaimed land are separated from the salt marshes of Morecambe Bay by manmade defences. Here the reclaimed landform is flat and derived from estuarine deposits and peat bodies that have developed since the last ice age. These areas are generally only a few meters above sea level with high groundwater tables including both loamy and peaty soils. The reclaimed landscape is virtually treeless with expanses of intensive pastoral agriculture, with large rectangular fields bounded by hedges, often with ditches, of comparatively recent origin. Within this landscape of grazing marsh, particularly around the Kent and Leven estuaries, expanses of lowland raised bog survive. These remnants, with their specialised plant communities, contrast markedly with the surrounding pastures and are of high importance for nature conservation. Occasionally, the raised bogs directly abut limestone, as at Roudsea, giving rise to unique transitions. Formerly, Leighton Moss would have been similar but following its reclamation for agriculture and subsequent abandonment the site has developed to become an extensive reedbed.

Farmsteads, hamlets and small villages are concentrated around the margins of the limestone geology, but are more widely scattered across the drumlin fields.

Ulverston, a market town from the 13th century, is the largest settlement within the area with Kendal lying just to the north. The settlements of Grange-over-Sands, Arnside, Silverdale and Milnthorpe are characterised by Victorian and Edwardian buildings and grew as a result of the increase in popularity of the area for recreation and retirement during the late 1800s. The larger settlements are generally associated with the rail network or with the historic trade route linking Lancaster to the pass between the Lake District and Howgill Fells.

The limestone which gives structure to the landscape is also the traditional building material. Until the mid-20th century, buildings throughout the NCA, as well as the market towns on its borders, were almost always built of limestone and roofed with Lake District slate. Quarrying of limestone was a significant local industry, and is still practised at a few sites, with the former quarries remaining a distinctive feature together with associated lime kilns positioned against low limestone cliffs. Rurally, large parts of the NCA were, and remain, owned by estates, with stately homes set in parkland and associated tenant farms.

The long history of human presence is evident in the landscape with Neolithic and bronze-age burial mounds and stone circles, medieval field patterns, Cistercian priories, coppiced woodlands, quarries, transport routes and Second World War airfields.

Recreation remains a major element of the economy. Quiet enjoyment of the features of the landscape, including the diversity of semi-natural habitats and their species and heritage features, is supported by an extensive rights of way network supplemented by areas of dedicated access, and includes the cross-bay walks whose origins lie in role of the sands as the safest way of crossing the NCA until the 19th century.

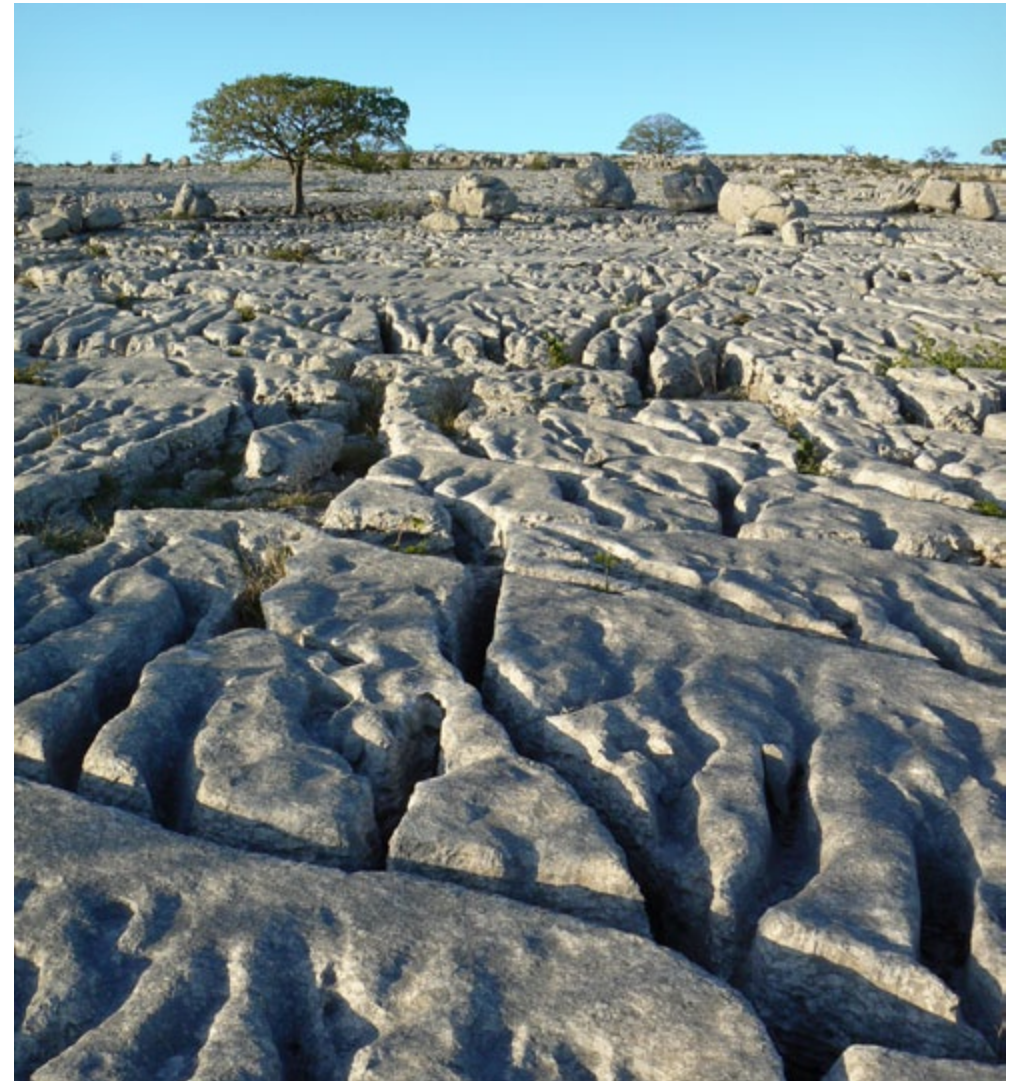
The landscape through time

The distinctive landscape on the margins of Morecambe Bay is largely determined by the pattern of much-faulted outcrops of Lower Carboniferous Limestone. In this area, thick and relatively pure limestone typically forms the upstanding blocks that make the NCA so distinctive. The pale fossil-rich sediments were deposited in the warm sea that covered most of England around 350 million years ago. Today there are excellent exposures of the coral-rich limestones which provide a record of these ancient seas. Glacial scouring during the last ice age removed many soils, resulting in bare limestone scars and larger cliffs with considerable accumulations of limestone scree. Post-glacial erosion has led to the development of extensive limestone pavements.

Glacial deposits, mainly till, form the floors of most of the valleys which separate the limestone hills. The ice also created depositional landforms such as the drumlin fields to the south of Kendal. During post-glacial times, the area experienced a series of changes in sea level which inundated a number of low-lying areas, submerging large parts of the drumlin field and establishing a margin of freshwater and coastal wetlands.

Neolithic and bronze-age monuments, including burial mounds and stone circles on the higher ground, testify to the development of agriculture and settlement; much of the former woodland cover had been lost by the beginning of the 2nd millennium BC. Many prehistoric settlements and enclosures, such as those on Birkrigg Common, have been conserved through their abandonment and use as unenclosed commons from the 1st millennium AD.

From the mid-12th century, a significant part of High and Low Furness was under the ownership of the Cistercians who founded Furness Abbey. The



The area's unique limestone pavements are a product of post-glacial erosion.

Cistercians were instrumental in developing productive sheep farms and also exploited the local reserves of iron ore. Both resulted in the gradual loss of tree cover in the uplands as a result of grazing and the denudation of many woodlands in order to provide a source of fuel for ore smelting. Important priories were also established at Cartmel and Conishead which extended the influence of the Church and the way in which the landscape developed in the western part of the NCA.

Pele towers, constructed to provide protection during a period of border raids in the 15th and 16th centuries, are found across the NCA at Hampsfell, Arnside

and Hazelslack. In more peaceful times, stately homes with gardens developed around towers previously used for defence, including Sizergh Castle, constructed around its original 13th-century pele tower, and Levens Hall, an Elizabethan mansion featuring one of the earliest topiary gardens in the world, established in 1692.

Many of the semi-natural woodlands in the area were managed on a 'coppice-with-standards' basis until the early 20th century. This allowed valuable construction timber to be extracted in the long term and allowed species such as ash and hazel to be coppiced. The coppice timber provided fuel, in the form of charcoal, for the smelting of iron and copper ores which were mined nearby and, in the late 18th and 19th centuries, provided material for the production of bobbins required by the emerging textile industry in Lancashire and supported the production of gunpowder.

Until recently there were few large settlements in the NCA itself. Kendal on its northern edge was on the main route north from Lancaster to Carlisle, but much of the NCA remained difficult to access until the installation of a turnpike road running westwards from Levens in 1820 and the later arrival of the railway. The westernmost parts of the NCA were best reached either by a long detour via Windermere or across the sands of Morecambe Bay until the 19th century, with Ulverston developing at the Furness peninsula end of the bay crossing. Reaching the area by sea was difficult because of the tides and shifting sands and, as a consequence, the coastal settlements remained small.

Early 19th-century enclosure dramatically altered the landscape, bringing into agricultural production formerly marginal areas of land both on the hill tops and on the coastal fringe. The largest lowland area enclosed was the Lyth Valley, a wetland transformed by an engineered network of drains



Lime kilns, as here at Jenny Brown's Point, remain a frequent sight on the limestone hills.

into cropping land in the space of a few years. The arrival of the railway brought cheaper produce and replaced the market for peat with coal. As a consequence, the valley reverted to being predominantly pastoral and has remained that way since. In contrast, reclaimed land at Heversham has survived as a mixed agricultural system since its enclosure in the 1850s.

On a modest scale, the area became popular with visitors from the 1750s onwards when crossing the sands of Morecambe Bay by coach and horse was considered an exciting prelude to a visit to the Lake District. In the early 1800s, the arrival of both the Lancaster Canal and the railway allowed the development of both trade and tourist links to the industrial heartlands of eastern Lancashire. In the Victorian period, the town of Grange-over-Sands and the villages of Arnside and Silverdale developed rapidly as seaside resorts, aided by the presence of the railway. The Furness Railway stimulated day trips from nearby conurbations in Lancashire and the demand for holiday facilities and retirement homes continued well into the 20th century. Today tourism remains an important part of the local economy, alongside agriculture, with increases in visitor numbers, and associated traffic, to coastal locations, the surrounding countryside and stately homes. Villages are slowly expanding with the demand for housing for the retired, holiday homes and for people commuting to Kendal and Ulverston.

The landscape continued to evolve throughout the 20th century with wartime developments such as the airfield at Cark, the flooding and subsequent development of the wetland of Leighton Moss, the focusing of the quarrying industry into fewer but larger sites and the incremental upgrading of the transport network including the construction of M6 and the upgrading of the A590 trunk road.



Harvesting the natural resources of the bay has long been a local activity.

Ecosystem services

The Morecambe Bay Limestones 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 Morecambe Bay Limestones NCA is contained in the 'Analysis' section of this document.

Provisioning services (food, fibre and water supply)

- **Food provision:** Pastoral farming on Grade 3 soil in the NCA provides meat and dairy produce, and there are small enterprises associated with features such as damson and apple orchards. The cockle fishery harvests natural resources on the sand flats of Morecambe Bay.

- **Biomass provision:** The extensive native woodland cover supports a growing wood fuel industry, with potential for more sustainable production, mainly supplying domestic markets through rotational coppice management.

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

- **Climate regulation:** The lowland raised bogs Foulshaw Moss and Meathop Moss, found to the north of the Kent Estuary and at Roudsea to the east of the Leven Estuary, are both a store and sequester of carbon when in good condition but can also be significant carbon emitters when degraded. The extensive woodland of the limestone outcrops and salt marshes of the bay fringe also have significant roles in carbon sequestration and storage.



Livestock grazing has been a feature of the salt marshes fringing the bay for hundreds of years.

- **Regulating water quality:** Wetlands such as riparian woodlands, fens and reedbeds (as nutrient sinks) and pastoral agricultural land (as a source of nutrients and sediments) play key roles in determining water quality both within the smaller watercourses of the NCA and in the transitional waters of the adjacent Morecambe Coast and Lune Estuary NCA, many of which are in poor condition.
- **Pollination:** The extensive areas of semi-natural habitat in the NCA support populations of pollinators – insects that are key not only to the maintenance of the many semi-natural habitats but also to food production.
- **Regulating coastal processes:** Salt marshes, which form the interface between the tidal flats of Morecambe Bay and the terrestrial hinterland, play a key role in regulating many processes, including both coastal flooding and coastal erosion.

Cultural services (inspiration, education and wellbeing)

- **Sense of place/inspiration:** The rich and varied character of the area is largely determined by the interrelationship between the species-rich grasslands, the semi-natural woodlands, the limestone hills, the contrasting drumlins, the coastal salt marsh and intertidal habitats and the presence of the wide expanse of Morecambe Bay. The highly distinctive and varied landscapes of the NCA, including the Lake District National Park and the Arnside and Sliverdale AONB, give the NCA a strong and unique sense of place. This contributes strongly to tourism in the area and, consequently, is intrinsic to the local economy.
- **Sense of history:** Visible historical features, ranging from Neolithic stone circles to traditional farmsteads, fieldscapes, manor houses, lime kilns

and Second World War airfields, testify to longstanding human land use. Grazing livestock have been a familiar sight on the salt marshes and upland commons for centuries.

- **Recreation:** The quality of the NCA landscape, recognised in the National Park and AONB designations, is complemented by an extensive rights of way network and nature reserves, building a strong natural tourism economy.
- **Tranquillity:** The high-quality semi-natural environment with both intimate woodlands and areas of quiet expanse are important tranquillity assets, particularly within the AONB.
- **Biodiversity:** The NCA has an unusually wide range of high-quality habitats underpinning its identity as a biodiversity hotspot important for a wide range of species and habitats associated with limestone, wetlands and coastal environments. Among others these include areas internationally designated as SAC and Special Protection Areas for limestone grassland, juniper scrub, limestone pavement, ash woodland, yew woodland, marl lakes, lowland raised bogs, rivers, salt marsh and mudflat and species including bittern, wintering waders and wildfowl.
- **Geodiversity:** The NCA contains a number of nationally important geological sites including cave systems and fossil assemblages, most notable of which are the limestone pavements and lowland raised bogs of which the NCA contains a significant part of the global resource.



Guided crossings of the sands have evolved over time from transport necessity to tourist attraction, charity fundraiser and cultural experience.



Statements of Environmental Opportunity

SEO 1: Protect and enhance the extensive mosaic of high-quality limestone habitats, including pavement, woodland, scrub and grassland, to create a coherent and resilient ecological network, retain a sense of place and maintain the strong relationship between the landscape and its underlying geology.

For example, by:

- Supporting the delivery of key actions in the Arnside and Silverdale Area of Outstanding Natural Beauty (AONB) and Lake District National Park management plans aimed at protecting and enhancing the limestone landscape.
- Protecting and managing geological features to promote further understanding of these internationally important geological exposures.
- Restoring and enhancing the suite of biological and geological Sites of Special Scientific Interest (SSSI) and Special Areas of Conservation (SAC) present within the National Character Area (NCA), through both targeted measures and wider promotion of the social, cultural, historical and economic value of these sites.
- Protecting and ensuring that the extensive limestone pavement of the NCA is under suitable management both for its unique geological features and for its associated biological habitats.
- Securing sympathetic management of the diverse range of limestone habitats, both inside and outside designated sites, through measures such as restoration of active management of coppiced and formerly coppiced woodlands, securing sustainable grazing regimes and limiting nutrient inputs throughout the catchments of marl lakes.
- Ensuring that transitional habitats, mosaics of different limestone habitats and areas that provide links between habitat patches are recognised and valued, with a particular focus on priority habitats and county wildlife sites.
- Ensuring that invasive species, such as cotoneaster, and native species freed from natural population controls, such as deer, are managed and do not damage the unique heritage of the NCA.
- Protecting and restoring limestone drystone walls as a boundary feature, maintaining the relationship between the boundary type and the underlying limestone geology.
- Supporting programmes that deliver social, cultural and economic benefits from sustainable management of the limestone landscape and promote interaction with it, such as educational and volunteer programmes that raise awareness and skills associated with traditional management of the landscape, for example coppice woodland management, traditional stock management practices and drystone walling.
- Sustainably managing and enhancing existing native woodland, while ensuring that there is sufficient retention of deadwood for wildlife. Conserving the area's rich legacy of significant archaeological sites associated with woodland exploitation.
- Protecting and restoring the ancient woodlands which form 43 per cent of the woodlands in the NCA, especially the plantations on ancient woodland sites.
- Promoting the establishment of a coherent and resilient network of limestone woodlands where they will not damage other important habitats and features, through expanding and linking existing woodlands, particularly ancient woodland, with areas of new planting.

Continued over...

SEO1 continued

- Ensuring regeneration within existing native woodland, through the exclusion of deer and livestock where necessary.
- Ensuring that habitat quality is sufficiently high to support habitat specialist species such as the Duke of Burgundy butterfly, high brown fritillary, pearl-bordered fritillary, Scotch argus butterfly, dormouse, hawfinch and others, including those that have been lost in the past such as the natterjack toad, small blue butterfly and goldilocks aster.
- Seeking opportunities to restore lost species, for their own conservation purposes and as a hallmark of the NCA's identity.
- Support and develop the potential of the NCA as a core area from which limestone species can colonise or re-colonise adjoining NCAs.



Encouraging coppice woodland management for wildlife and the local economy has many benefits.

SEO 2: Ensure the long-term sustainable management of the nationally and internationally designated coastal zone by conserving and managing its habitats, including the extensive sand flats, salt marshes, estuarine landscapes and limestone cliffs, for their strong sense of inspiration and tranquillity, their diverse range of species, their traditional fisheries, and for their ability to mitigate the effects of climate change through carbon sequestration and coastal flood mitigation.

For example, by:

- Securing sympathetic management of the diverse array of high-quality semi-natural habitats of the coastal zone both inside and outside designated sites including coastal woodlands, coastal scrub and grasslands, coastal and flood plain grazing marsh, salt marshes and coastal cliffs.
- Restoring and enhancing the NCA's suite of coastal SSSI, SAC, Special Protection Areas (SPAs) and Ramsar sites and their component habitats and geological features, such as salt marsh geomorphology and coastal geological exposures, through both targeted measures and wider promotion of the sensitivity and value of these sites.
- Delivering key actions in the Arnside and Silverdale AONB and Lake District National Park management plans aimed at restoring and enhancing coastal character.
- Ensuring that invasive species, such as cotoneaster and buddleia, are managed and do not damage the unique coastal grassland heritage of the NCA.
- Ensuring that habitat quality is sufficiently high to support specialist species such as breeding and wintering waders and wildfowl, grayling butterfly, spiked speedwell and spotted cat's-ear, including species that have been lost in the past such as the natterjack toad, the small blue butterfly and the goldilocks aster.

Continued over...



A number of species including spiked speedwell are at the northern edge of their range here, enabled by the maritime influence of the bay, but are highly sensitive to changing management.

SEO 2 continued

- Ensuring that sustainable management extends beyond the designated site network so that the wider coastal zone is sympathetically managed with a particular focus on priority habitats, locally important sites and sites that support transitional habitats such as brackish wetlands; where present these should be valued, and where necessary they should be restored and re-created to provide ecological links, reinforce the character of the NCA and support the provision of ecosystem service benefits.
- Securing sustainable management of coastal fisheries and shellfisheries.
- Supporting programmes that deliver social, cultural and economic benefits from sustainable management of coastal resources and promote informed interaction with the coastal landscape, such as educational and volunteer programmes that raise awareness and skills associated with traditional interaction with the coastal landscape such as traditional fisheries and cross-bay travel.
- Recognising the predicted impacts of climate change, including sea level rises and an increase in storm events. Preparing for them by seeking opportunities to maintain dynamic coastal processes and, where appropriate, restore dynamic processes in order to maintain the coast and its habitats in line with the Shoreline Management Plan policies and related strategies, particularly around the reclaimed estuary coastlines of the rivers Kent and Leven where the likelihood of impacts driving change is greatest.
- Conserving archaeological evidence of earlier settlement and land use and, where appropriate, securing off-site conservation of artefacts at risk from coastal change, with reference to heritage-at-risk priorities and bespoke surveys such as English Heritage's Rapid Coastal Zone Assessment Survey for Morecambe Bay.
- Providing a coastal access route that allows for improved access to, and understanding of, the coast while respecting the sensitive habitats and species of the coastal margin.

SEO 3: Ensure the long-term sustainable management of the nationally and internationally designated wetland landscape and its linking, non-designated, habitats by conserving and restoring the lowland raised bogs, fens, rivers and reedbeds for their strong sense of inspiration and tranquillity, their diverse range of species, and for their ability to mitigate the effects of climate change through carbon sequestration.

For example, by:

- Securing sympathetic management of the diverse array of high-quality wetlands both inside and outside designated sites, including rivers, marl lakes, lowland raised bogs, coastal and flood plain grazing marsh, reedbeds and wet woodlands.
- Restoring and enhancing the suite of biological and geological SSSI, SAC, SPAs and Ramsar sites and their habitats present in the NCA, through both targeted measures and wider promotion of the value of these sites.
- Delivering key actions in the Arnside and Silverdale AONB and Lake District National Park management plans aimed at restoring and enhancing wetlands.
- Ensuring that invasive species, such as signal crayfish and Himalayan balsam, are managed and do not damage the unique heritage of the NCA.
- Ensuring that wetland habitat quality is sufficiently high to support specialist species such as bittern, white-faced darter dragonfly, large heath butterfly, breeding lamprey and eels and others, including those that have been lost in the past such as corncrake, natterjack toad, marsh gentian and silver-studded blue butterfly.
- Seeking opportunities to restore lost wetland species, both for their own conservation and as a hallmark of the NCA's identity.
- Restoring and buffering lowland raised bogs by working with farmers, landowners and others to manage water levels in and adjacent to these sites, protecting them for their biodiversity, carbon sequestration and climate record, and implementing tree removal and managed grazing regimes, where appropriate, to restore water-holding capacity, encourage active peat formation, protect peaty soils and increase resilience to climate change.
- Seeking through infrastructure improvements and better land management practice to address diffuse pollution in the Kent, Leven and Keer river catchments, and in the catchments of Leighton Moss, Hawes Water and Cunswick Tarn.
- Supporting programmes that reduce pressure on grazing marsh to receive inputs of nutrients, particularly along watercourses and at times of year when there is high risk of nutrient run-off.
- Maintaining the relationship between boundary type and the structure of the landscape with hedges with flanking ditches on areas of reclaimed land.
- Managing hedges and ditches so that they support stock management as well as providing pollen, nectar, food and physical habitat for wildlife.
- Developing approaches to pastoral management that protect and enhance soil condition, in particular on soils prone to waterlogging and compaction on flood plains and areas of reclaimed land.

Continued over...

SE3 continued

- Ensuring that sustainable management extends beyond the designated site network so that the wider wetland landscape, particularly priority habitats, locally important sites and sites that support transitional habitats, are sympathetically managed, providing ecological links between core sites, supporting species associated with the wider wetland landscape such as breeding waders, reinforcing the character of the NCA and supporting the provision of ecosystem service benefits.
- Supporting programmes that deliver social, cultural and economic benefits from sustainable management of wetland resources and promote informed interaction with the wetland landscape, such as educational and volunteer programmes that raise awareness of the unique range of wetlands in the NCA and promote skills associated with traditional management, such as wetland grazing.
- Aiming to develop the potential of the NCA as a core area from which species can re-colonise adjoining NCAs.
- Promoting the ecosystems service benefits of wetlands, such as lowland raised bogs and carbon sinks and stores, and farmland wetlands as nutrient sinks.



Largely managed as nature reserves lowland raised bogs are not only important for biodiversity but sequester carbon and provide opportunities for quiet enjoyment of the areas natural heritage.

SEO 4: Conserve and enhance the wider landscape of the NCA as the supporting framework to its distinctive attributes, including features of the drumlin landscape, the settlement character, orchards, recreational identity and heritage features, for their individual importance and the complementary role they play in supporting the local visitor economy and providing enjoyment and education to visitors and residents alike.

For example, by:

- Capturing the benefits provided by the breadth of the high-quality NCA landscape across economic sectors such as tourism, recreation, food, and fuel at all stages in the chain from source to market.
- Enhancing the structure and extent of the access network including footpaths, bridleways and cycle routes to provide opportunities for all abilities, and to improve the value of this network to the local economy.
- Maintaining and restoring the cultural habitats of the NCA including the orchards, parklands and meadows.
- Maintaining the relationship between boundary type and the structure of the landscape with walls of field stone on drumlins, and hedges on areas of deeper soil.
- Managing hedges, where present, so that they support stock management as well as providing pollen, nectar, food and physical habitat for wildlife.
- Seeking opportunities to preserve and adapt traditional skills to modern markets to maintain NCA character and increase the economic profile of landscape support industries. For example by developing bay crossings as a recreational opportunity; traditional coppice work and wood fuel business as a supporter of a green economy; and low-impact agriculture, based on traditional grazing regimes and orchard produce, as a provider of locally branded quality food for direct marketing and the hospitality sector.
- Supporting and promoting green tourism initiatives and other programmes that explicitly capture the high quality of the NCA landscape as an economic asset and coupling these with information on how to experience the NCA without compromising its assets. Making best use of the direct transport links between the NCA and areas of high population, for example Manchester and London, and the offer of low-carbon outdoor recreation experiences such as walking and cycling.
- Seeking opportunities to restore sites and features that are part of their associated historical context, such as parklands around stately homes and orchards around farmsteads and settlements.
- Where appropriate, promoting opportunities for new woodland creation, both to link and buffer existing sites and to address water quality and flood control.
- Supporting and promoting the role played by land management in supporting the key attributes of the NCA, particularly those businesses that focus on producing quality items in a manner that enhances the NCA's character, such as meat from livestock sustainably grazed on priority habitats, and produce from damson orchards.
- Promoting programmes which seek to reduce the negative off-site impacts of land management and infrastructure developments, such as the Catchment Sensitive Farming Programme which supports farm adaptations that reduce impact on water quality through reduced nutrient and sediment loading of watercourses.

Continued over...

SE4 continued

- Delivering the management plans of the AONB and National Park which expressly link the natural and cultural value of the landscape.
- Encouraging sustainable planning including green infrastructure that respects and enhances the character of the NCA, such as the use of local limestone in building, and using native species in green space design to support the identity and value of the wider landscape.
- Conserving and enhancing the traditional farmsteads and distinctive vernacular architecture of the area, ensuring that new uses for redundant buildings are compatible with their historic character.
- Seeking opportunities to increase the robustness of the landscape in dealing with the impacts of climate change, such as including species whose ranges need to adapt in some planting schemes and establishing protocols for managing new pests and diseases.



Levens Hall. The area's rich cultural heritage is an important asset to many users.

Supporting document 1: Key facts and data

Total area: 39,966 ha

1. Landscape and nature conservation designations

This NCA contains three areas of designated landscape – the Lake District National Park, the Arnside and Silverdale Area of Outstanding Natural Beauty (AONB) and the Forest of Bowland AONB. In this NCA the Lake District National Park covers 7,481 ha (19 per cent of the NCA), Arnside and Silverdale AONB covers 5,858 ha (15 per cent of the NCA) and the Forest of Bowland AONB 1,505 ha (4 per cent of the NCA). In total these designations cover 38 per cent of the NCA.

Management plans for each protected landscapes can be found by following the links below:

- www.lakedistrict.gov.uk/
- www.arnsidesilverdaleaonb.org.uk/
- www.forestofbowland.com/

Source: Natural England (2011)

Please note: Part of this NCA is affected by an Order extending the Lake District National Park. This will not take effect unless confirmed by the Secretary of State. Please see www.naturalengland.org.uk/lakestodales for current status.

1.1 Designated nature conservation sites

The NCA includes the following statutory nature conservation designations:

Tier	Designation	Name	Area (ha)	Percentage of NCA
International	Ramsar	Morecambe Bay; Leighton Moss	2,983	7
European	Special Protection Area (SPA)	Morecambe Bay SPA; Leighton Moss SPA	2,983	7
	Special Area of Conservation (SAC)	Morecambe Bay SAC; Morecambe Bay Pavements SAC; Witherslack Mosses SAC; Roudsea Wood and Mosses SAC; River Kent SAC	6,363	16
National	National Nature Reserve (NNR)	Whitbarrow NNR; Roudsea Wood and Mosses NNR; Gait Barrows NNR; Hutton Roof NNR; Clawthorpe Fell NNR	1,178	3
National	Site of Special Scientific Interest (SSSI)	A total of 37 sites wholly or partly within the NCA	7,075	18

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.

Morecambe Bay Ramsar, SAC and SPA all overlap and are composed of Morecambe Bay SSSI and part of Roudsea woods and Mosses SSSI in this NCA.

Morecambe Bay Pavements SAC is made up of Farleton Knott, Hutton Roof

Crags, Scout and Cunswick Scars, Gait Barrows, Hawes Water, Cringlebarrow and Deepdale, Thrang End and Yealand Hall Allotment, Thrang Wood, Underlaid Wood, Middlebarrow, Marble Quarry and Hale Fell, and Whitbarrow SSSI.

Witherslack Mosses SAC is made up of Nichols Moss, Foulshaw Moss, and Meathop Moss SSSI.

Roudsea Wood and Mosses SAC is part of Roudsea Wood and Mosses SSSI. Leighton Moss Ramsar and SPA overlap Leighton Moss SSSI.

River Kent SAC is part of River Kent SSSI.

There are 212 local sites in the Morecambe Bay Limestones NCA covering 2,519 ha which is 6 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: 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> – select ‘Designations/Land-Based Designations/Statutory’

1.2 Condition of designated sites

SSSI condition category	Area (ha)	Percentage of SSSI land in category condition
Unfavourable declining	399	6
Favourable	3,268	46
Unfavourable no change	632	9
Unfavourable recovering	2,776	39

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

The elevation of the NCA varies from sea level around the Morecambe Bay fringe to 270 m on the highest of the limestone escarpments.

Source: Natural England (2010)

2.2 Landform and process

The NCA is characterised by flat lowlands broken up by steep limestone escarpments many of which include exposures of limestone pavement. This landform owes its origins to two distinct geological processes. The limestone escarpments were formed by volcanic uplift associated with the periphery of the Lake District volcanic zone. These have then been worn by glacial processes leaving exposed rocks with patches of glacial till. Below the escarpments the landform is depositional including areas of drumlin fields, both fluvial and estuarine sediments, interspersed with raised peat bogs.

Source: Natural England (2010)

2.3 Bedrock geology

The dominant bedrock geology in this NCA is associated with sedimentary strata exposed by volcanic uplift on the periphery of the Lake District Fells, and in particular Lower Carboniferous limestone. This is generally exposed as distinct blocks of varying sizes that arise through the drift geology.

Source: Natural England (2010)

2.4 Superficial deposits

Superficial deposits in the NCA are derived from two particular sources. Away from the coastal lowlands superficial geology is derived from glacial sediments transported from the central Lake District and deposited during the retreat of

the Lake District ice cap, forming drumlin fields in some places. In the coastal margins superficial deposits are largely derived from estuarine processes and peat formation.

Source: Natural England (2010)

2.5 Designated geological sites

Tier	Designation	Number
National	Geological Site of Special Scientific Interest (SSSI)	5
National	Mixed interest SSSI	3
Local	Local Geological Sites	27

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

Dominant soils are free draining over limestone geology – acid where associated with glacial drift deposits and more base-rich where they are thinner. Soils with high groundwater, including both loamy and peat types, are found in areas where soils are estuary derived, and wet acid soils predominate in the eastern part of the NCA. The NCA is characterised by agriculturally poor soils with Grade 3 soils being the best quality. These are mainly found in the low lying parts of the NCA where they are associated with superficial deposits, particularly reclaimed salt marsh and flood plain lands, but become more extensive on the more gentle limestone geology of the western limit of the NCA. Grade 4 soils are mainly linked to areas of glacial till overlying limestone bedrock with Grade 5 soils and non-agricultural soils associated with areas where glacial action has little soil depth.

Source: Natural England (2010)

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

Agricultural Land Classification	Area (ha)	Percentage of NCA
Grade 1	0	0
Grade 2	0	0
Grade 3	19,344	49
Grade 4	12,585	32
Grade 5	4,492	11
Non-agricultural	1,254	3
Urban	570	1

Source: Natural England (2010)

Maps showing locations of sites can be found at: <http://magic.defra.gov.uk> – select 'Landscape' (shows ALC and 27 types of soils).

3. Key waterbodies and catchments

3.1 Major rivers/canals

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

Name	Length in NCA (km)
Lancaster Canal	19
River Gilpin	8
River Keer	11
River Kent	12
River Lune	8
River Winster	12

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.

With the exception of the largely groundwater-fed River Keer which rises and discharges in this NCA, the main natural watercourses in the NCA are surface water-fed and arise either in the adjacent South Cumbria Low Fells NCA or the Cumbria High Fells NCA which are more upland in character and flow south through the NCA on their way to discharge into Morecambe Bay. The River Lune forms part of the southern boundary of the NCA. In addition to these natural watercourses the Lancaster Canal passes through the eastern part of the NCA, though it is only open for part of its length. The canal was an important trade route before the arrival of the railway.

3.2 Water quality

The total area of Nitrate Vulnerable Zone is 3,559 ha; 9 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

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

4. Trees and woodlands

4.1 Total woodland cover

The NCA contains 5,940 ha of woodland (15 per cent of the total area), of which 2,538 ha is ancient woodland.

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

4.2 Distribution and size of woodland and trees in the landscape

The NCA has a high native woodland cover associated in particular with areas of thin soils over limestone that results in unproductive farmland. Woodland cover is particularly extensive on the sides of the limestone massifs and in the Arnside and Silverdale AONB. Many of these woods were traditionally managed as coppice linked to the production of bobbins, gunpowder and lime from quarried limestone, reinforcing the link between woodlands and areas of exposed limestone geology.

Source: Natural England (2012)

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)	Percentage of NCA
Broadleaved	4,398	11
Coniferous	593	1
Mixed	519	1
Other	430	1

Source: Forestry Commission (2011)

Area and proportion of ancient woodland and planted ancient woodland sites (PAWS) within the NCA.

Woodland type	Area (ha)	Percentage of NCA
Ancient semi-natural woodland	1,791	4
Ancient re-planted woodland (PAWS)	747	2

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

On areas of solid limestone geology fields are generally enclosed by limestone walls with hedgerows and ditches, often co-located, dominating in low lying areas on estuary-derived superficial deposits and flood plains. In areas dominated by glacial drift deposits boundaries are a mix of walls and hedgerows. The estimated length of boundary features in the NCA is about 2,838 km, of this 682 km (24 per cent) is under Environmental Stewardship management.

Source: Morecambe Bay Limestones Countryside Character Area description; Countryside Quality Counts (2003)

5.2 Field patterns

In areas dominated by solid geology field patterns tend to be small and disorganised having evolved around individual farmsteads. On both plateau areas and in the valley bottoms field patterns become more regular having been established in a planned manner as part of land reclamation schemes, such as reclamation of salt marsh and draining of peatlands for agriculture or peat extraction and enclosure of plateau areas.

Source: Morecambe Bay Limestones 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

Of the 440 holdings in the NCA more than 72 per cent are livestock oriented with both meat and dairy based enterprises. There is very little arable and horticulture, but more than 20 per cent of farm types are classified as 'other' which is a category that includes commercial holdings with only horses, or only specialist grass and forage, or only fallow and unknown.

Source: Agricultural Census, Defra (2010)

6.2 Farm size

About 60 per cent of farms are less than 50 ha, but by area holdings of 50 ha or more account for 84 per cent of the farmed land area, with 56 per cent of the farmed area being accounted for by holdings of over 100 ha.

Source: Agricultural Census, Defra (2010)

6.3 Farm ownership

Of the farmed area 59 per cent is owned, a figure which has fallen by 10 per cent since 2000 when 70 per cent of farm land was owned. There are a number of large landowning estates with tenanted farms.

Source: Agricultural Census, Defra (2010)

6.4 Land use

Land use is generally pastoral agriculture with 93 per cent of the land by area being given over to grass for grazing, and just 4 per cent down to cereals and other arable crops.

Source: Agricultural Census, Defra (2010)

6.5 Livestock numbers

Sheep are the main livestock type in the NCA (74 per cent of stock) though cattle make up 25 per cent and are the main livestock type in some areas. In 2009 there were 103,024 sheep (down from 132,474 in 2000) and 35,381 cattle (down from 37,710) and 689 pigs (down from 1,577).

Source: Agricultural Census, Defra (2010)

6.6 Farm labour

Of the 917 farm employees the majority are principal farmers (71 per cent of work force) with full- and part-time workers accounting for a further 20 per cent of the work force.

Source: Agricultural Census, Defra (2010)

Please note: (i) Some of the Census data are estimated by Defra so may not present a precise assessment of agriculture within this area (ii) Data refers to commercial holdings only (iii) Data includes land outside of the NCA where it belongs to holdings whose centre point is recorded as being within the NCA.

7. Key habitats and species

7.1 Habitat distribution/coverage

This NCA has a particularly diverse range of habitats lying in close proximity and associated with all the principal land types. On the limestone massifs species-rich calcareous grasslands and limestone woodlands are prominent features. In the coastal lowlands salt marshes are a feature of the coastal fringe backed by wetlands habitats including reedbeds and lowland raised bogs. Other habitats are more scattered but include a significant presence of orchards, meadows, unimproved grasslands, fens and open waterbodies including a marl lake at Hawes Water.

Wetland habitats

The range of wetland habitats in the NCA is exceptional and encompasses the complete range from highly acidic lowland raised bog to highly alkaline springs and marl lakes; from strongly saline coastal salt marshes to fresh water systems; and from still waters to fast flowing rivers all of which include high quality examples.

The NCA's coastal fringe is generally defined by the presence of extensive areas of grazed salt marshes. While among the freshwater habitats the extensive areas of lowland raised mire are an important feature of the lowland plain where it is generally found in extensive areas of coastal and flood plain grazing marsh, the most extensive wetland habitat in the NCA. At Leighton Moss the reedbeds have colonised an area of former farmland and support a number of rare species at the north-west limit of their British range such as bittern. Of the rivers the Kent is the most diverse, supporting water crowfoot beds, white-clawed crayfish, and spawning grounds for salmon and lamprey. The marl lake at Hawes Water is considered one of the best examples of its kind in

the country, while the scattered tarns along the northern fringe of the NCA are noted for their medicinal leech populations.

Limestone habitats

The Carboniferous Limestone escarpments support a range of notable habitats including species-rich grasslands, scrub and woodlands, including both coppice and high forest types and exceptional extents of yew woodland, often all present in a tight mosaic. More locally coastal limestone grasslands are present, and throughout there are frequent exposures of limestone pavement.

The limestone grasslands are characterised by the presence of blue moor-grass, locally common but virtually endemic to north-west England, mixed with a wide range of species including rare plants and insects. Where these grasslands become coastally influenced additional species add to the diversity. Scrub communities often include juniper stands and Lancastrian Whitebeam, which is endemic to this NCA, while woodlands are mainly ash-hazel but, along with the scrub, include a number of which are at the northern fringe of their range supported by the local micro-climate. Where woodlands are coppiced the invertebrate communities are particularly notable as well as a range of rare birds and mammal species. Scattered throughout the limestone areas are expanses of limestone pavement which support a characteristic flora drawn from limestone woodland and grasslands as well as hosting a number of additional habitat-specific species.

Source: Cumbria fells and Dales Natural Area Profile

7.2 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; 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.

Priority habitat	Area (ha)	Percentage of NCA
Coastal and flood plain grazing marsh	5,379	13
Broadleaved woodland (broad habitat)	1,827	5
Lowland calcareous grassland	1,246	3
Lowland raised bog	888	2
Upland calcareous grassland	854	2
Limestone pavement	776	2
Lowland dry acid grassland	583	1
Lowland meadows	164	<1
Lowland heathland	147	<1
Mudflats	33	<1
Maritime cliff and slope	33	<1
Purple moor grass and rush pastures	14	0
Upland hay meadow	7	0
Reedbeds	4	<1
Fens (1)	0	0

Source: Natural England (2011)

Note: In addition there are some 2,423 ha of coastal salt marsh. (1) This figure is believed to be an underestimate

Maps showing locations of priority habitats are available at:

- <http://magic.defra.gov.uk> – Select ‘Habitats and Species/Habitats’

7.3 Key species and assemblages of species

- Maps showing locations of some key species are available at: <http://magic.defra.gov.uk> – Select ‘Habitats and Species/Habitats’
- Maps showing locations of S41 species are available at <http://data.nbn.org.uk/>

8. Settlement and development patterns

8.1 Settlement pattern

The predominant settlement pattern across the NCA is one of small villages and hamlets with few settlements having grown to market town size within the NCA, although a number of market towns are located on the NCA boundary. Settlement patterns reflect the distribution of natural resources in the landscape with individual villages having grown up around agriculture, fishing, coppice or quarrying sites and their associated small scale industries such as lime making, bobbin making and gun powder making.

The settlements that have grown are mainly those associated with transport networks such as bay crossing points, the Kendal to Lancaster Canal, Ulverston Canal, and the railway network, reflecting both the influence of trade and visitors on the economy. In recent decades the nucleated structure of villages has declined with an increase in second homes and retirement homes and the shift to villages providing homes for people commuting to places of work.

Source: Morecambe Bay Limestones Countryside Character Area description; Countryside Quality Counts (2003)

8.2 Main settlements

Within the NCA settlements are generally small with Ulverston being the largest settlement in the NCA and Grange-over-Sands, and Arnside being the other principal settlements. However, the market towns of Kendal, Carnforth, Dalton

in Furness, and Kirkby Lonsdale are all on the border of the NCA, and serve the NCA. The total estimated population for this NCA (derived from ONS 2001 census data) is: 125,930.

Source: Morecambe Bay Limestones Countryside Character Area description; Countryside Quality Counts (2003)

8.3 Local vernacular and building materials

The local style of building very much reflects the availability of limestone as a material suitable for both houses and other constructions such as road and canal bridges, factories and lime kilns. On the edge of the NCA Kendal is locally known as the 'Auld grey town' reflecting the dominance of limestone as a building material. Lake District slate was generally used as roofing material and the distribution of buildings built in this style gives a visual coherence to the older parts of settlements.

Source: Morecambe Bay Limestones Countryside Character Area description; Countryside Quality Counts (2003)

9. Key historic sites and features

9.1 Origin of historic features

The earliest visible features in the landscape date to the Neolithic period with Birkrigg stone circle commanding a prominent view across Morecambe Bay. However despite a long history of human occupation, including Roman occupation most of the features of the visible historic landscape date from the medieval or more recent periods.

The first of the parklands can be dated to the 12th and 13th centuries, with the earliest buildings at Leighton Hall and Sizergh Hall being established in this period, to be followed by the Dallam, Holker and Levens Halls, the latter dating to 1580. During this period the priories of Conishead and Cartmel both exerted a strong influence which can still be seen.

During the 15th and 16th centuries the border raids resulted in the fortification of many farmsteads, with Pele towers still standing at Hamps Fell, Arnside, Hazelslack, Sizergh, and Beetham

The ornamental gardens at Levens Hall are of particular note, originally laid out by the Frenchman Beaumont in 1692.

Many of the surviving features from more recent centuries are utilitarian in origin, such as lime kilns positioned against low limestone cliffs, the Lancaster to Kendal canal with its many pack horse bridges and the Hincaster tunnel, gunpowder works on the River Kent dating from the late 18th century and which financed Sedgwick House, the corn mill at Beetham, and the Second World War airfield at Flookburgh.

One of the most prominent landmarks in the area is the Hoad Monument overlooking Ulverston, a concrete copy of the Eddystone Lighthouse built in 1850 to commemorate statesman and local resident Sir John Barrow.

Source: Countryside Quality Counts Draft Historic Profile, Countryside Character Area description

9.2 Designated historic assets

This NCA has the following historic designations:

- 5 Registered Parks and Gardens covering 333 ha.
- No Registered Battlefields.
- 74 Scheduled Monuments.
- 762 Listed Buildings.

Source: Natural England (2010)

More information is available at the following address:

- <http://www.english-heritage.org.uk/caring/heritage-at-risk/>

10. Recreation and access

10.1 Public access

- Eleven per cent of the NCA, 4,424 ha, is classified as being publically accessible.
- There are 567 km of public rights of way at a density of per 1.4 km².
- There are no National Trails within the NCA.

Sources: Natural England (2010)

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

Access designation	Area (ha)	Percentage of NCA
National Trust (Accessible all year)	462	1
Common Land	1,332	3
Country Parks	41	<1
CROW Access Land (Section 4 and 16)	3,104	8
CROW Section 15	1	<1
Village Greens	65	<1
Doorstep Greens	0	0
Forestry Commission Walkers Welcome Grants	872	2
Local Nature Reserves (LNR)	79	<1
Millennium Greens	0	0
Accessible National Nature Reserves (NNR)	820	2
Agri-environment Scheme Access	1	0
Woods for People	1,816	5

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) with few major settlements away from the periphery of the NCA and a limited network of major roads the NCA as a whole is relatively tranquil, with the highest tranquillity score being associated with the edge of Morecambe Bay.

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

Tranquillity	Tranquillity Score
Highest value within NCA	54
Lowest value within NCA	-64
Mean value within NCA	3

Sources: CPRE (2006)

More information is available at the following address:

<http://www.cpre.org.uk/resources/countryside/tranquil-places>

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 that intrusion is highest around the larger settlements in, and adjoining, the NCA and the main roads that link the principal settlements. A breakdown of intrusion values for this NCA is detailed in the table below.

Intrusion category	1960s (%)	1990s (%)	2007 (%)	Percentage change (1960s-2007)
Disturbed	10	34	49	40
Undisturbed	84	59	49	35
Urban	<1	<1	2	6

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are a major shift from an undisturbed to disturbed area associated with increased traffic and in particular the opening of the M6 and upgrading of trunk roads.

More information is available at the following address:

<http://www.cpre.org.uk/resources/countryside/tranquil-places>

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 Inventory of Woodland & Trees, Forestry Commission (2003)
- Countryside Quality Counts Draft Historic Profiles, English Heritage (2004)*
- Ancient Woodland Inventory, Natural England (2003)
- 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)Detailed River Network, Environment Agency (2008)

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 and trends

Trees and woodlands

- By 2003 the area of woodland covered by England Woodland Grant Scheme management agreements was about 19 per cent of the eligible area. About 49 per cent of the woodland cover is on an ancient woodland site, and the proportion of these sites covered by a Woodland Grant Scheme agreement increased from 12 per cent in 1999 to 27 per cent in 2003.
- Local changes in the distribution of different woodland types have arisen as a consequence of programmes restocking harvested non-native plantations and plantation ancient woodland sites with native trees species, and the restoration of non-native plantations to open habitats, particularly on Sites of Special Scientific Interest (SSSI).
- Decline in woodland condition has occurred outside of Arnside and Silverdale Area of Outstanding Natural Beauty (AONB) as a result of inadequate management and problems with grazing by deer that have prevented natural regeneration in places.

Boundary features

- The estimated boundary length for the NCA is about 2,838 km of which between 1999 and 2003 about 8 per cent was in management to enhance or restore its quality. By 2011 this had increased to approximately 24 per cent under agri-environment scheme management including hedges, walls and ditches.

- In some parts of the NCA dedicated programmes have targeted formerly neglected boundary features, such as limestone drystone walls in the Arnside and Silverdale AONB, for restoration, which has led to local improvement in the extent and condition of boundary features.

Agriculture

- Between 2000 and 2009 there was a general drop in livestock numbers with a 6 per cent drop in cattle and a 22 per cent drop in sheep numbers – the two dominant livestock types in the NCA. Most land remains as part of pastoral systems but between 2000 and 2009 there were small increase in both cereal and non-cereal arable, this is likely to reflect the move to maize and to a lesser extent whole-crop cereals as a winter feed for stock, particularly cattle.
- Through the latter half of the 20th century many species associated with the managed agricultural landscape have declined in the NCA particularly those associated with wet grasslands and pastures, such as curlew, redshank and yellow wagtail. This decline is associated with incremental intensification in agricultural management with development such as silage production, slurry spreading, and reseeded of grasslands affecting bird breeding success.

Settlement and development

- Since the 1960s, there has been a 35 per cent loss of undisturbed to disturbed areas associated with increased traffic and in particular the opening of the M6 and upgrading of trunk roads.

- The slow expansion of many of the villages, particularly to the east, due to the development of housing for the retired and second homes and for people who work in Kendal and Ulverston has impacted on the local character and the social structure of settlements.

Semi-natural habitat

- The area of SSSI is significant at 18 per cent of land cover. Of this there has been an increase from 57 per cent in 2003 to 85 per cent in 2011 of the SSSI area in favourable or recovering condition. In addition to national designated sites there has been a considerable increase in the extent of other priority habitat under agri-environment or English Woodland Grant schemes.
- Historically there has been a significant loss in the extent of limestone pavement due to quarrying or removal for ornamental garden features. However, since the early 1980s this loss has largely been halted through Limestone Pavement Order protection.
- In the second half of the 20th century there were declines in woodland and grassland butterfly species with the decline of high brown fritillary, pearl-bordered fritillary and Duke of Burgundy being particularly well documented.
- A number of specialised plants particularly those associated with low-nutrient grassland and wetland environments have also declined, and in a number of cases local extinctions have resulted.
- Invasive non-native species are an issue in some areas, for example cotoneaster invasion of limestone habitats, and Himalayan balsam along riparian corridors.

Historic features

- In 1918 about 3 per cent of the NCA was historic parkland, but by 1995 it was estimated that 32 per cent of this area had been lost. In 2003 about 24 per cent of the remaining parkland was covered by an Historic Parkland Grant, and 23 per cent included in an agri-environment scheme.
- There is a trend for barns to be converted for residential use. While most existing historic farm buildings are intact structurally, in 2003 only about 71 per cent remained unconverted.
- Loss of historic sea defences and coastal archaeology due to increased erosion of marshes and damage to historic features through scrub encroachment and erosion is an issue in places.

Coast and rivers

- Most of the NCA shore is salt marsh, and intertidal mud and sand flats, which are dynamic and change in distribution over time, changing the character of individual stretches of coastline and their settlements.
- Around the river estuaries there have been local changes in salt marsh distribution resulting from both natural and man-induced movement of the river channels requiring ongoing flexible management.
- In addition there have been some changes in the structure of salt marshes with a large increase in the extent of the invasive *Spartina cord-grass* in the intertidal zone since its colonisation of Morecambe Bay in the 1960s.

Minerals

- Although the total number of sites has declined over time, quarrying continues to be a local industry with three large scale active sites, at Sandside, Over Kellet, and Holme, all quarrying limestone.
- Except where open habitat is being maintained for biodiversity or geological interest, former quarry sites, which are present on all the main limestone outcrops, are generally developing into woodland communities.

Drivers of change

Climate change

- Evidence from UK Climate Impacts Programme (UKCPO9) shows that over the coming century the climate of North West England is expected, on average, to become warmer and wetter in winter and hotter and drier in summer.⁴
- Under 2009 predictions for the medium emissions scenario by 2080: mean winter temperatures will increase by 2.6 degrees, mean summer temperatures will increase by 3.7 degrees, winter precipitation will increase by 16 per cent, summer precipitation will decrease by 22 per cent and there will be an increase frequency of extreme events (floods/droughts).⁵
- The high structural diversity of the landscape within the NCA has resulted in it being identified as being moderately vulnerable to climate change

⁴ North West Landscape Framework – Climate Change Assessment, Natural England (2010); URL: http://www.naturalengland.org.uk/Images/introduction_tcm6-26352.pdf

⁵ UK Climate Projections Science Report: Climate change projections, Met Office (2009); URL: <http://ukclimateprojections.metoffice.gov.uk/media.jsp?mediaid=87851&filetype=pdf>

but having potentially high robustness to climate change, if adaptation processes are taken into account. In general vulnerability to climate change is highest for coastal and wetland habitats and lowest for grasslands and woodlands. This reflects both the structural diversity of the habitats and the robustness of their communities to changes in environmental conditions such as temperature and rainfall.

- The impacts of climate change, such as sea level rise, increased storminess and both coastal and fluvial flood events, will require the coastal zone to be able to adapt to these changes. This will offer opportunities to create a sustainable coastal environment where natural coastal processes are allowed to take place unimpeded.
- Likely impacts on salt marsh are highly dependent on management. If sustainable management is in place salt marsh accretion may offset sea level change and help to buffer increased coastal energy. However, if salt marsh extent declines through over grazing limiting accretion, it is likely that associated decline in condition will reduce their capacity to mitigate climate change impacts such as coastal flooding events and their capacity to store carbon.
- Peatlands may dry out during prolonged droughts, increasing the risks of soil erosion and wildfires, resulting in loss of habitat, stored carbon and archaeological pollen record.
- Species associated with the NCA are likely to change as species on the northern edge of their range colonise and consolidate their presence while species at the southern edge of their range decline. However, the high structural variability of the landscape, particularly around the limestone blocks, with associated local variations in climate may help offset some

losses. Habitat connectivity will be needed to address species movement and adaptation to climate change while there may be an increased need for tailored management of semi-natural habitats to ensure they can still support broad suites of specialist species.

- The risk of the spread of invasive species and plant and animal disease, such as ash die-back may be helped by changing climate and may impact on key species such as ash and juniper. While drought impacts may also affect the composition of woodland communities.
- Increasing demand for national food security and associated increases in food prices combined with predicted changes in rainfall, temperature, frequency of storm events and sea level may cause changes in agricultural practices, for example a longer growing season. Maintaining viable farm businesses balancing food production and delivery of other multiple benefits may require adaptation of businesses.

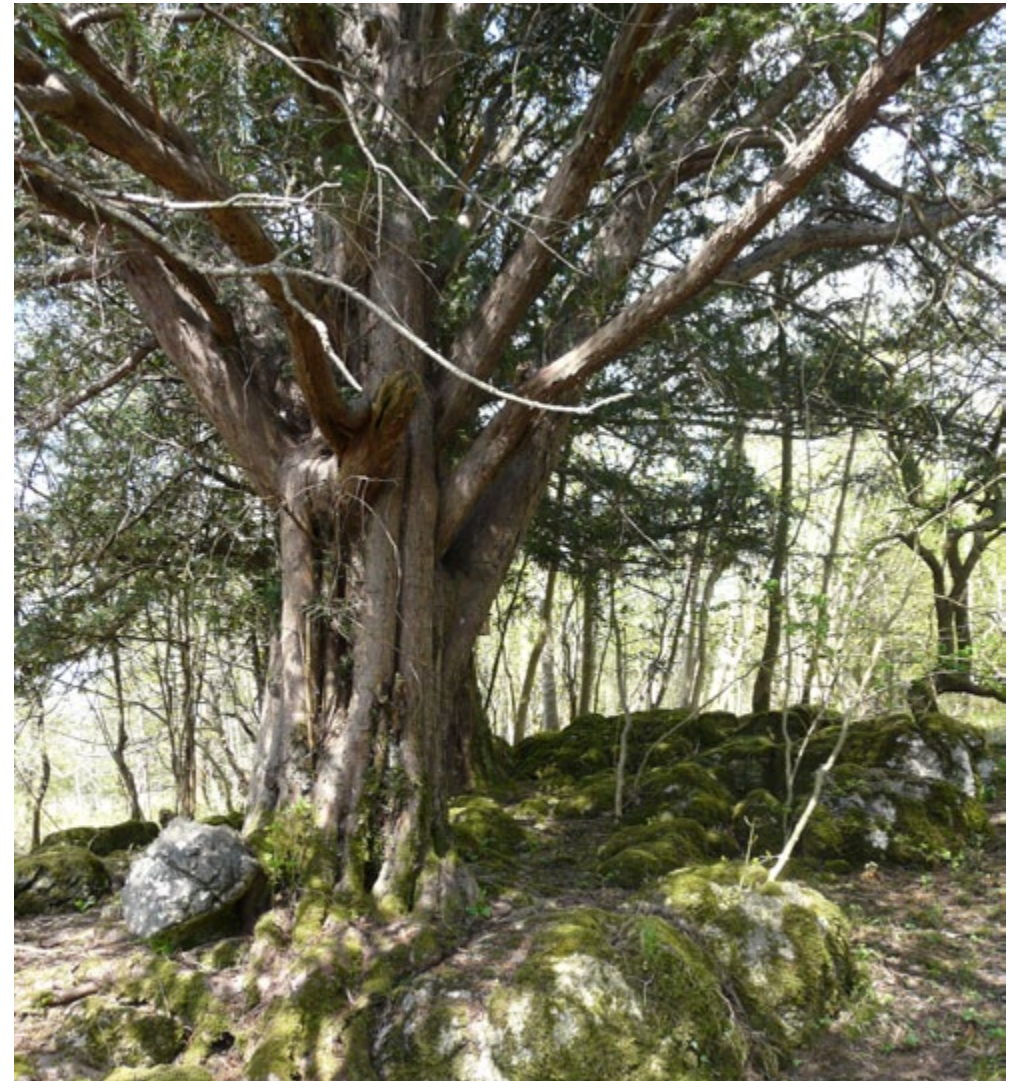
Other key drivers

- Housing needs will continue to exert pressure on the landscape with planning policy focusing on development within the boundaries of existing settlements. This may impact on individual settlement character through pressure for infill development, loss of associated features such as orchards and increased prevalence of generic housing styles.
- High property values and increased consolidation of farmland are likely to continue to exert pressure on the farmstead structure of the rural landscape with many farmsteads and associated out buildings being converted to residential complexes and the formerly associated farmland being remotely managed from other farms.



Non-native cotoneaster smothering limestone grassland, juniper and Lancastrian whitebeam - one of a number of invasive non-natives, which is a threat to the area's heritage.

- Colonisation and increases in populations of invasive non-native species such as cotoneaster, buddleia, grey squirrel, signal crayfish and muntjac deer may impact on semi-natural habitats and important native species.
- Continued demand for limestone for building and road aggregate will continue to support demand for quarry sites.
- High desirability of the area for second homes and retirement will continue to affect affordability of the area for many and risks breaking the link between local residency and intimate understanding of the management of the local landscape. Conversely the desirability of the area will maintain pressure for a conservative approach to developments potentially modifying the character of the landscape.
- Increased leisure time among a rising proportion of the population may increase recreational demand within the area. This challenge needs careful management if sensitive sites and species are to be maintained while providing recreational opportunities that will benefit health and wellbeing.
- Future development of the England Coastal Path will need to be sensitively managed through the NCA in order to minimise any negative impacts on the coastal corridor while creating opportunities for enjoyment of the local environment.
- Increased pressure for renewable energy may alter character. Impacts would vary depending on the type of development and its scale with wind turbines potentially affecting views both from and within the NCA, solar panels becoming an increasing feature of settlements and wood fuel affecting the proportion of woodlands under active management.



Ancient yews often emerge from the soil-less pavements.

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.



Along the coast and on exposed ridges, trees are shaped by the wind.

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	Tranquillity	Recreation	Biodiversity	Geodiversity
SEO 1: Protect and enhance the extensive mosaic of high-quality limestone habitats, including pavement, woodland, scrub and grassland, to create a coherent and resilient ecological network, retain a sense of place and maintain the strong relationship between the landscape and its underlying geology.	↗ ***	↑ ***	↗ ***	↗ ***	↑ ***	↗ ***	↗ ***	↗ ***	↗ ***	↗ ***	↗ ***	↗ **	↔ ***	↑ ***	↗ ***	↗ ***	↗ ***	↑ ***	↗ ***
SEO 2: Ensure the long-term sustainable management of the nationally and internationally designated coastal zone by conserving and managing its habitats, including the extensive sand flats, salt marshes, estuarine landscapes and limestone cliffs, for their strong sense of inspiration and tranquillity, their diverse range of species, their traditional fisheries, and for their ability to mitigate the effects of climate change through carbon sequestration and coastal flood mitigation.	↗ ***	↔ ***	↗ ***	↗ ***	↑ ***	↑ ***	↑ ***	↑ ***	↗ ***	↗ ***	↑ ***	↗ **	↔ ***	↑ ***	↗ ***	↗ ***	↗ ***	↑ ***	↗ ***
SEO 3: Ensure the long-term sustainable management of the nationally and internationally designated wetland landscape and its linking, non-designated, habitats by conserving and restoring the lowland raised bogs, fens, rivers and reedbeds for their strong sense of inspiration and tranquillity, their diverse range of species, and for their ability to mitigate the effects of climate change through carbon sequestration.	↘ **	↔ **	↗ ***	↗ ***	↑ ***	↑ ***	↑ ***	↑ ***	↑ ***	↑ ***	↗ **	↗ **	↔ ***	↗ ***	↗ ***	↗ ***	↗ ***	↑ ***	↗ ***
SEO 4: Conserve and enhance the wider landscape of the NCA as the supporting framework to its distinctive attributes, including features of the drumlin landscape, the settlement character, orchards, recreational identity and heritage features, for their individual importance and the complementary role they play in supporting the local visitor economy and providing enjoyment and education to visitors and residents alike.	↗ ***	↗ ***	↔ ***	↗ ***	↗ ***	↗ ***	↗ **	↗ **	↗ ***	↗ ***	↗ ***	↗ **	↗ ***	↑ ***	↑ ***	↗ ***	↑ ***	↗ ***	↗ ***

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 attributes

Landscape attribute	Justification for selection
<p>A lowland landscape arcing around the head of Morecambe Bay with the undulating farmland broken up by conspicuous limestone blocks including prominent scars, cliffs, scree and exposed pavement.</p>	<ul style="list-style-type: none"> ■ The dominant bedrock geology in this NCA is associated with sedimentary strata exposed by volcanic uplift on the periphery of the Lake District Fells, and in particular Lower Carboniferous limestone (47 per cent). ■ The NCA has frequent exposures of limestone pavement, in total covering 776 ha of the NCA, making up a significant proportion of the national and global resource. The area's limestone pavements are of international importance for geology and nature conservation with a large area designated as Morecambe Bay Pavements Special Area of Conservation (SAC) under the EC Habitats Directive. They also receive additional protection through Limestone Pavement Orders. ■ The NCA contains three areas of designated landscape – the Lake District National Park, the Arnside and Silverdale Area of Outstanding Natural Beauty (AONB) and the Forest of Bowland AONB. ■ The freely draining nature of limestone means that water bodies are rare in the area but they do occur in small clay lined basins which are of particular interest due to their alkaline fauna and flora. ■ Locally quarried limestone is a key building material throughout the NCA, defining the character of most of the settlements in the NCA and, through its use as walling stone, much of the structure of the rural landscape. Quarrying has been a key local industry for both building and the production of lime. ■ Early field patterns, particularly on footslopes, are often highly irregular reflecting the moulding of artificial boundaries to natural outcrop and topographical variations. ■ Settlement patterns are strongly influenced by the geology with many settlements being sited on the edge of limestone blocks with access to adjacent areas of different geology. ■ Many important archaeological sites are associated with the limestone geology including caves with pre-historic features and stratified deposits, the Birkrigg Stone Circle and numerous lime kilns, which are generally built into outcrops.

Landscape attribute	Justification for selection
<p>The coastal edge of the NCA is a dynamic, horizontal landscape consisting of a wide expanse of shifting intertidal sand flats, open salt marsh and gravelly or muddy beaches backed by low limestone cliffs contrasting with the grey and sandy bay beyond.</p>	<ul style="list-style-type: none"> ■ The shifting pattern of texture, colour and play of light across its surface means the visual character of Morecambe Bay is constantly changing. ■ A dynamic landscape that through the effects of tidal erosion and deposition results in significant changes to the pattern and balance of salt marsh, sands and river channels of the Leven and Kent. ■ The salt marsh of the coastal fringe around the Kent and Leven act as a natural tidal defence providing important ecosystem service function. ■ The NCA's entire coastline is subject to SSSI, SAC, SPA and Ramsar designations because of its exceptional value for wildlife and significantly contributes to the area's role as a biodiversity hotspot. ■ Large numbers of wildfowl and waders present along the coastal fringe provide considerable interest throughout the year and the areas bird assemblage is considered internationally important. ■ The coastal limestone cliffs and grasslands around Arnside and Silverdale and Humphrey Head support an exceptional diversity of 'oceanic limestone' specialist plants. ■ The wide expanse of flat and open salt marsh mean sheep and cattle grazing as been a characteristic feature of the coastal fringe for centuries. ■ Salt marsh turf of such a high quality that it is cut for bowling greens and other amenity purposes in some locations.
<p>Extensive semi-natural woodland cover inland provides a contrast with the often sparse tree cover in coastal areas.</p>	<ul style="list-style-type: none"> ■ Coppice woodlands characteristic of many parts of the area, most notably the Low Furness and Arnside-Silverdale areas. ■ High native woodland cover (14.9 per cent) associated with areas of thin soil over limestone and on the sides of limestone massifs. ■ Approximately 49 per cent of the woodland cover is ancient woodlands and 27 per cent of these sites are covered by a Woodland Grant Scheme.
<p>Small- to medium size fields bounded by locally sourced limestone walls or hedgerows with few hedgerow trees. In areas where agricultural land has been reclaimed field sizes are typically larger, with hedgerow boundaries associated with ditches.</p>	<ul style="list-style-type: none"> ■ Early field patterns, particularly on footslopes, are often highly irregular reflecting the moulding of artificial boundaries to natural outcrops and topographical variations. ■ In areas dominated by solid geology field patterns tend to be small and disorganised having evolved around particular farmsteads. ■ On both plateau areas and in the valley bottoms field patterns become more regular and larger, having been established in a planned manner as part of land reclamation schemes.

Landscape attribute	Justification for selection
<p>Agricultural land cover is principally pastoral, for grazing and stock feed. Rough grazing is a feature of the higher grounds on unimproved limestone grass or rough fell vegetation.</p>	<ul style="list-style-type: none"> ■ Land use is generally pastoral agriculture which accounts for over 70 per cent of farms by type and 93 per cent of land by area. ■ Free draining limestone with limited soil depth has strongly influenced agricultural practise by limiting ploughable land leading to a highly pastoral landscape whose structure has persisted through periods of agricultural intensification. ■ At the head of the Leven and Kent estuaries there are extensive areas of former lowland raised mire, which have been cut for peat or drained and reclaimed for agriculture. ■ Rough grazing is found on the higher limestone hills.
<p>A richness of diverse, high quality semi-natural habitats, of national and international importance, including limestone pavements, herb-rich grasslands, species-rich scrub, semi-natural coppice woodland, peaty fenlands, reedbeds and mosses making the area a biodiversity hotspot.</p>	<ul style="list-style-type: none"> ■ The rich and varied character of the area is determined by the interrelationship between the diverse habitats, striking geology and the wide expanse of Morecambe Bay. ■ Areas of internationally and nationally important coastal habitats noted for their bird assemblages, limestone pavement, limestone grassland and heath, lowland raised bogs and woodland.
<p>An exceptional range of wetland habitats encompassing the complete range from highly acidic lowland raised mires to highly alkaline springs and marl lakes; saline coastal salt marshes to fresh water systems; and from still waters to fast flowing rivers all within close proximity.</p>	<ul style="list-style-type: none"> ■ The lowland raised mires surrounding the limestone outcrops have largely been reclaimed for agriculture. The Witherslack Mosses SAC and Roudsea Woods and Mosses SAC, represent some of the most extensive areas of intact lowland raised bog in lowland England. ■ The Leighton Moss reserve is located on the site of a former raised mire drained for agricultural purposes and has since been allowed to flood and develop as a reedbed providing habitat for species at the north western limit of their British range such as bittern and bearded tit. ■ The marl lake at Hawes Water is considered one of the best examples of its kind in the UK and supports a diverse aquatic plant community and freshwater mollusc fauna. ■ The upland tarns found along the northern fringe of the NCA support medicinal leech populations. ■ The River Kent, and other rivers, supports a range of species such as eel, spawning sea lamprey, salmon, sea trout, otter and white-clawed crayfish.

Landscape attribute	Justification for selection
<p>Evidence of historical land use and settlement since the Neolithic period.</p>	<ul style="list-style-type: none"> ■ Burial mounds and stone circles confirm that the area was farmed in Neolithic times and there is evidence of early burials at Dogholes Cave in the limestone on Wharton Crag, Silverdale. ■ Evidence of medieval field patterns, especially around the villages of Great and Little Urswick. ■ A significant area of High and Low Furness was under ownership of the Cistercians who founded Furness Abbey. The Cistercians enterprises included sheep farming and exploiting the local iron reserves, leading to the gradual loss of cover on the uplands through over grazing and the harvesting of wood fuel for smelting the ore. Important priories were also established at Cartmel and Conishead, further spreading the churches influence on the local landscape. ■ Many semi-natural woodlands in the area managed on a ‘coppice-with-standards’ basis up until the 19th century, with timber providing fuel, in the form of charcoal, for the smelting of iron and copper ores. Timber also provided material for the production of bobbins required by the burgeoning Lancashire textile industry. ■ Grange-over-Sands and the Arnside-Silverdale developed as popular seaside resorts with demand continuing into the 21st century. ■ Transport routes have contributed to local settlement patterns with towns and villages initially associated with the cross bay routes. The 19th-century arrival of the Lancaster Canal and later the railway shifted the development focus more inland.
<p>A number of historic stately homes with parkland and well maintained gardens open to the public.</p>	<ul style="list-style-type: none"> ■ Five registered parks and gardens covering 333 ha. ■ Dispersed settlement pattern with large areas of tenanted farmland reflects past ownership patterns associated with estate ownership. ■ Leighton Hall and Sizergh Castle established in the 12th and 13th centuries, followed by Dallam, Holker and Levens Halls, the latter dating to 1580. ■ Levens Hall features one of the world’s earliest topiary gardens which was laid out by the Frenchman, Beaumont, in 1692.

Landscape opportunities

- Protect and enhance the internationally important suite of limestone habitats including pavements, ash and yew woodlands, marl lakes, and grasslands.
- Protect and enhance the coastal habitats, in particular salt marshes and limestone cliffs.
- Conserve and enhance key sites for vulnerable species, such as wintering waders and wildfowl and breeding waders along the coastal margin.
- Manage and expand the wetland habitats, in particular the lowland raised bogs, reedbeds, rivers, coastal and flood plain grazing marsh.
- Maintain and restore the mix of the landscape with different coastal, limestone and wetland communities in close proximity and, in the Arnside and Silverdale AONB, tight and intimate mosaics.
- Maintain, restore and celebrate key attributes of the different designated landscapes emphasising the distinctive character of the area.
- Seek opportunities to enable the landscape to adapt, in keeping with its character, to impacts of climate change such as proactively adapting the coastline, working with tidal processes to build land levels in coastal areas and managing change in areas prone to flooding.
- Restore and manage the ancient woodland and traditional management practices such as coppicing and seek opportunities to expand cover of native species and link existing sites.
- Develop opportunities from wood fuel, timber, and tourism businesses to bring undermanaged woodlands into management to produce multiple benefits.
- Restore habitats so they are better able to support species in decline.
- Protect native species and priority habitats from the effects of invasive non-natives such as signal crayfish, Himalayan balsam and cotoneaster.
- Protect and conserve the areas rich and diverse archaeology; from Neolithic and bronze-age earth works, through to industrial archaeology represented by lime kilns, quarries and water mills and the historic buildings and vernacular stone-built architecture.
- Protect and enhance the managed cultural habitats, in particular the orchards of villages and farmsteads, meadows and estate parklands.
- Protect and enhance the character of the estate landscape; maintaining the relationships of historic buildings, designed landscapes and associated communities.
- Protect and manage geological features and associated habitats for their expression of geological processes and associated rare flora and fauna.
- Protect and conserve the historic field patterns and network of drystone walls, hedgerows and boundary trees and scrub that contribute to the NCA's sense of place.

- Restore and protect boundary features to maintain the relationship between them and the variation in local geology.
- Manage development pressures affecting the natural and cultural attributes through careful handling of the introduction of further urban elements such as overhead lines, wind farms and expansion of settlements.
- Manage development and tourism to avoid impacting on the sense of place, history and the area's tranquillity, through encouraging the use of traditional building design, sensitive location of new developments and encouraging the use of public transport systems.
- Encourage improvement to access routes, especially where it is possible to link existing path networks and sites of interest, and provide interpretation, to enable more people to enjoy and understand the NCAs diverse natural, geological and cultural heritage.
- Prepare for the impacts of climate change on semi-natural habitats for example by diversifying species and provenances, where appropriate, to ensure resilience against tree disease threats for example to juniper and ash.



Limestone walls topped by Lake District slate is the common style to the area's farms, villages and towns.

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 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	<p>Grade 3 agricultural land supporting pastoral systems</p> <p>Semi-natural habitats including limestone grasslands and salt marsh</p> <p>Orchards and in-hedge fruit trees.</p> <p>Intertidal sand flats support traditional and shell fisheries</p>	<p>The NCA is characterised by agriculturally poor soils with Grade 3 soils (49 per cent), the best quality, found in the low-lying parts of the NCA where they are generally associated with drift geologies such as reclaimed salt marsh and flood plain. These become more extensive on the undulating geology in the west of the NCA. Grade 4 soils (32 per cent) are linked to areas of glacial till overlying limestone bedrock.</p> <p>Agricultural land in the NCA is mainly managed as pastoral systems, including a significant proportion of dairy farms.</p> <p>Open habitats in designated sites are sometimes grazed by rare breed animals, particularly cattle.</p> <p>Few of the remaining orchards in the NCA can be considered to be good condition with little replacement of dead and dying trees resulting in remnant population of scattered individual trees. Orchards, particularly damsons, are important for production of local produce such as damson gin.</p> <p>Morecambe Bay is renowned for its flat fishing and for its shellfish.</p>	Regional	<p>Many areas on the coastal plain consist of reclaimed land that was formerly flooded either by rivers or the sea. These areas form some of the best farmland in the NCA but are dependent on flood banks, artificial drainage and, in the case of the Lyth Valley, a pump network to support current agricultural practise. There may be increasing pressure on these types of management systems with the impacts of climate change.</p> <p>In some areas former organic soils have been lost through historic peat cutting for fuel, or more recently as a consequence of intensive management, such that in many areas only a thin soil layer is left over underlying estuarine clay deposits.</p> <p>Food security is likely to be increasingly important. Expansion of food provisioning needs to be managed in a sustainable way which does not impact upon other ecosystem services.</p> <p>A number of businesses in the NCA market locally sourced rare breed meat, and traditional fishery and orchard (particularly damson) products, supporting the rural economy. The extensive areas of semi-natural agricultural habitat, in particular limestone pastures (many of which are designated as SSSI and SAC), are well suited to extensive management supporting these businesses.</p>	<p>Manage and protect productive soil reserves to ensure they are maintained into the future.</p> <p>Promote the development of food products and markets associated with local produce from low-input and extensive management of livestock systems.</p> <p>Ensure that future agri-environment schemes are used to best effect to maintain food production and preserve the wildlife-rich habitats and traditional skills associated with meat and dairy production.</p> <p>Support activities leading to sustainable fisheries to secure a long term food resource and sustainable management of the habitats.</p> <p>Explore opportunities to enhance and expand management of traditional orchards and their products as a sustainable local product in association with farmsteads and small villages.</p> <p>Support and promote markets for products from rare breeds.</p>	<p>Food provision</p> <p>Biodiversity</p> <p>Regulating soil quality</p> <p>Regulating soil erosion</p> <p>Regulating water quality</p> <p>Sense of place / inspiration</p> <p>Sense of history</p>

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Timber provision	Soils Existing woodland High regional rainfall	<p>Woodland cover is 5,940 ha (15 per cent of NCA area) with 4,398 ha of broadleaved woodland (11 per cent), 593 ha of coniferous (1 per cent) and 519 ha of mixed woodland (1 per cent). 2,538 ha is ancient woodland.</p> <p>In a study covering part of Morecambe Bay Limestones and South Cumbria Low Fells NCAs it was found that there are 12,946 ha of woodland of which around 3,371 ha (26 per cent) is considered to be under-managed. Undermanaged woodland is largely broadleaved or mixed.</p> <p>Woodlands of this NCA are associated with historical industrial activity providing timber for smelting, charcoal production, bobbins and lime kilns.</p>	Local	<p>Managed woodlands in the NCA cover a range of stand types with the best quality timber going for timber and poorer quality material for other uses such as wood fuel.</p> <p>Work by the Forestry Commission (FC) (2011) has identified that the NCA has a larger potential timber resource than is currently be utilised which would be suitable for fuel wood or building, while supporting the contribution the woodland makes to landscape character and the habitat mosaic in the area. This report makes the link between a low Carbon economy and a sustainable resource which, with sympathetic management, could also deliver both biodiversity and cultural benefits.</p> <p>Historically many of the woodlands in the area were managed under coppice regimes with standing wood harvested at ground level on 12 to 15 year rotations with selected trees left as standards to develop into timber trees. This management resulted in woodlands having a mixed structure with areas of different ages. While this has declined greatly, coppice management for timber continues in the area and has the potential to expand again.</p> <p>Many woodland areas have potential to fulfil dual roles with timber provision and access provision for recreation.</p> <p>With deer populations of both native and non-native species increasing in the area deer management may be necessary to ensure woodland regeneration. This has been identified as an issue in a number of the woodlands in the area.</p>	<p>Promote sustainable management of woodlands to ensure the long term production of timber whilst retaining the contribution they make to the landscape and enhancing their biodiversity interest.</p> <p>Bring existing broadleaved woodlands into management to increase production of timber for local use.</p> <p>In formerly coppiced systems support the restoration of coppice management of woodland as a management practise.</p> <p>Ensure good links are established between the local timber resource and local markets.</p> <p>Support the planting of new native-species woodlands particularly where these link existing woodland blocks and do not damage other important habitats.</p> <p>Seek opportunities to enhance recreational access in areas being primarily managed for timber.</p>	<p>Timber provision</p> <p>Biodiversity</p> <p>Sense of place / inspiration</p> <p>Sense of history</p> <p>Biomass provision</p> <p>Regulating water flow</p>

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability	<p>High rainfall directly and via limestone aquifers</p> <p>Rivers from surrounding upland catchments</p>	<p>The NCA does not overlay any major aquifers. The NCA's major rivers are the Winster, Gilpin, Kent, Leven and Keer. Parts of the eastern edge of the NCA drain to the River Lune. The main rivers in the NCA drain the southern fells of the Lake District into Morecambe Bay. The availability status of these surface waters is generally 'water available' or 'not assessed' except for the River Lune in the south east of the NCA which has 'no water available'.^{6,7}</p>	Local	<p>Water is abstracted from a tributary of the River Keer to fill the Lancaster Canal, which from Tewittfield south is connected to the national canal network. North of Tewittfield the canal is no longer intact and relies on local water sources. If proposals to restore the northern reach are undertaken new abstraction points will be needed. Formerly water was abstracted from the River Kent catchment in Kendal.</p> <p>Much of the River Kent is a SAC and Morecambe Bay is also covered by international designations, meaning that river flow levels and the availability of water are important considerations in the management of these designated sites.</p> <p>Drinking water is sourced from reservoirs in the Cumbria High Fells NCA. At one site in the area water is extracted from minor underground aquifers and sold as bottled water.</p>	<p>Promote sustainable use of local water sources.</p> <p>Restore and enhance semi-natural habitats of open fells, native woodlands, lowland raised bogs and reedbeds to improve water storage capacity while also reducing flood risk and soil erosion and improving water quality, climate regulation, habitat networks and ecosystem resilience to climate change.</p> <p>Work with the farming community to ensure continued sustainable management to improve soil structure and water, retaining habitats to increase infiltration and reduce surface flow.</p>	<p>Water availability</p> <p>Regulating water quality</p> <p>Biodiversity</p> <p>Regulating soil erosion</p>

⁶The River Kent CAMS, Environment Agency (March 2004; URL: www.environment-agency.gov.uk/business/topics/water/119927.aspx)

⁷The Lune CAMS, Environment Agency (March 2004; URL: www.environment-agency.gov.uk/business/topics/water/119927.aspx)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Genetic diversity	Local and traditional livestock breeds	Traditional rare breeds, particularly cattle, are a feature of the land management regime of many areas of semi-natural habitat.	Local	<p>The Bagot goat, which is believed to have been brought to Britain during the crusades of the 13th century, gets its name from the Bagot family who are the owners of the Levens Hall estate. The deer park flanking the River Kent at Levens, which forms part of the estate, is grazed by a herd of these goats.</p> <p>the extensive areas of limestone pasture, and to a lesser extent wet grazing marsh, are well suited to grazing by rare breed cattle, and in different parts of the NCA breeds including Galloway, Welsh Black, Highland, White Park, Blue Greys and Redpoll can be found.</p> <p>The orchards of the area contain a wide variety of apple cultivars as well as damsons for which the area is well known. Generally these were grown in orchards, associated with farmsteads and villages though damsons were also grown as hedgerow standards. A number of apple cultivars originate in the NCA including Duke of Devonshire, Keswick codin, and Taylor's favourite. The historic extent of orchards is greatly reduced through loss to village expansion and the neglect of farmstead orchards.</p>	<p>Promote rare breeds for their suitability in managing rough pastures, calcareous grasslands and other semi-natural habitats.</p> <p>Encourage the development of supply chains and markets for high quality local produce.</p> <p>Maintain association between Bagot goat and Levens estate.</p> <p>Restore traditional orchards where they survive and establish orchards with local varieties where appropriate.</p>	<p>Genetic diversity</p> <p>Biodiversity</p> <p>Food provision</p>
	Local origin of the rare Bagot goat breed	Deer park at Levens estate grazed by Bagot goat herd.				
	Traditional orchards	Few of the remaining orchards in the NCA can be considered to be good condition with little replacement of dead and dying trees resulting in remnant population of scattered individual trees.				

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biomass energy	Woodland including traditional coppiced woodlands	The existing woodland cover (15 per cent) provides wood fuel and offers moderate potential for increased provision of biomass through bringing unmanaged woodland under management. There is limited potential for biomass crops, particularly short rotational coppice, in the flat or undulating lowland areas, away from the coastline, but much of the landscape is designated, and therefore, there is a need for very sensitive siting of any future biomass crops.	Local	<p>The area has mixed potential yields for short rotation coppice, with high potential inland up to Kendal, medium potential around Ulverston and generally low potential along the coast. Potential miscanthus yield is generally high, although medium in the Storth-Arnside area, around Ulverston and inland towards Kendal. For information on the potential landscape impacts of biomass plantings within the NCA, refer to the tables on the Natural England website at: http://www.naturalengland.org.uk/ourwork/farming/funding/ecs/sitings/areas/default.aspx</p> <p>Significant potential exists to develop biomass provision through the re-establishment of coppice management in many established, and formerly coppiced, woodlands. Although this management may offer a lower short-term economic return it is entirely in keeping with the past management of the landscape, including that of the designated landscapes, and offers a range of ecosystem service benefits.</p> <p>Some areas of woodland are found in areas that have the potential to be restored to open habitats of significant biodiversity value, in particular lowland raised mires, for which this NCA has a significant share of the national resource. Removal of these trees, many of which are not of economic grade could offer a one-off additional biomass source.</p>	<p>Seek opportunities to bring existing broadleaved woodlands into management at appropriate sites to increase production of wood fuel for local use.</p> <p>In formerly coppiced systems support the restoration of coppice management as a management practise.</p> <p>Develop local wood fuel markets and seek opportunities to link potential resource to markets.</p> <p>Restore areas such as lowland raised mires to open habitat, using the one off crop of wood fuel in local markets.</p> <p>Increase cover of coppice woodland, traditional or short rotation, in locations that would not impact on biodiversity or historic environment interest, and would enhance local landscape character.</p> <p>Support the planting of new native-species woodlands particularly where these link existing woodland blocks and do not damage other important habitats.</p>	<p>Biomass energy</p> <p>Biodiversity</p> <p>Regulating water flow</p> <p>Sense of place / inspiration</p> <p>Sense of history</p> <p>Climate regulation</p>

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation	<p>Carbon-rich soils</p> <p>Carbon sequestering and storing wetlands, in particular lowland bogs</p> <p>Woodlands</p> <p>Coastal habitats including salt marshes and mudflats</p>	<p>The soils of the NCA have a varied carbon content, being generally medium (5-20 per cent) in upland areas such as the area between Kendal and Witherslack but low (0-5 per cent) elsewhere, reflecting that 72 per cent of the NCA area is covered by mineral soils.</p> <p>Areas of higher soil carbon are likely to be under the NCA's woodland, wetland, coastal and unimproved grassland habitats, with particularly high carbon levels in the peat soils of the raised mires at the head of the Kent and Leven estuaries. The latter acting both as carbon stores and active sequesters of carbon when in good condition.</p> <p>Many mires are however in poor condition resulting in them being net emitters of greenhouse gasses.</p> <p>As well as carbon storage by soils, the woodlands, covering (15 per cent of the area) also sequester and stores carbon in their biomass. Woodlands in the area are undermanaged with regards their climate regulation potential and ability to offset other carbon releasing energy sources.</p> <p>Intertidal habitats are also important carbon stores, with the salt marshes of the NCA generally considered to be under favourable management.</p>	National	<p>The peat and organic soils of the NCA have potential to sequester carbon when under appropriate management. Soil carbon levels are highest in areas formerly characterised by carbon sequestering habitat types such as mosslands and flood plains. Carbon storage is also offered by the extensive woodland cover with the carbon balance being enhanced where it is under active management.</p> <p>Loss of semi-natural habitat, drainage of wetlands and afforestation of woodlands will result in the loss of soil carbon and that stored in vegetation, and significantly reduced the ability of habitats to continue to sequester carbon in the future.</p> <p>Restoration of semi-natural habitats aid their ability to act as a carbon sink. Of particular importance in this area are the active lowland raised peat bogs in the Lyth and Winster valleys, at the head of the Kent estuary. Here, management measures can secure the condition of peat as a carbon store.</p> <p>Increasing the active management of woodlands, particularly to supply the wood fuel industry, offers a low-carbon energy source reducing pressure on fossil-fuel carbon energy as well as increasing carbon storage in standing biomass.</p> <p>The salt marshes and mudflats of the coastal margin are also important carbon stores, through the sequestering of atmospheric carbon by vegetation and the trapping of mobile sediments.</p>	<p>Restore peatland and other wetland habitats by establishing an appropriate hydrological regime to allow carbon sequestration and to increase species diversity, including bryophytes.</p> <p>Maintain and increase woodland cover on non-peat soils and promote woodland management.</p> <p>Work with the farming community to ensure continued sustainable low-input and extensive livestock farming systems that allow for carbon sequestration and soil development.</p> <p>Promote opportunities for a low carbon economy through development of local supply chains for wood fuel, promotion of energy sources that complement local character and through mechanisms such as carbon credits which could support the management of important habitats.</p>	<p>Climate regulation</p> <p>Biodiversity</p> <p>Sense of history</p> <p>Sense of place / inspiration</p> <p>Regulating water flow</p>

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	Surface water catchments	<p>The ecological status of the NCA's main rivers is mainly 'good' but with the River Kent and the Lancaster Canal rated as 'moderate'. The ecological status of Morecambe Bay into which the NCA's rivers ultimately drain is 'moderate'. The chemical status of surface waters is generally not assessed although the Rivers Kent and Leven have good chemical status.</p> <p>The chemical status of groundwater is 'good'.⁸</p> <p>There are no monitored European bathing waters in this NCA though discharges into the transitional waters are recognised as affecting bathing waters in the adjacent Morecambe Coast and Lune Estuary NCA. Smaller watercourses are not routinely monitored and this could hide local issues.</p>	Local	<p>Much of the main river water quality in the NCA is determined by the water that flows in from upstream which highlights the importance of catchment scale management and consideration of the links between upland and lowland systems</p> <p>Because of the impact on water quality parts of the NCA are identified as 'Nitrate Vulnerable Zones' requiring agricultural management to take into account off site impacts of nitrates.</p> <p>Diffuse pollution is a particular issue in the Leighton Moss – Hawes Water catchment where the internationally important wetlands are acting as nutrient sinks receiving both surface and ground water from their surrounding catchment. This area is being targeted for water quality improvement through diffuse water pollution plans to reduce nutrient loading.</p> <p>Addressing diffuse pollution in the Kent and Keer catchments has been identified as important to improve water quality by the Environment Agency. As a consequence the Kent, Keer and Leven catchments are being targeted by the Catchment Sensitive Farming programme which focuses on farm infrastructure and land management measures to address point sources of pollution.</p> <p>Limestone performs a water purification function 'cleaning' groundwater and enhancing water quality where spring lines bring the ground water to the surface, particularly around the fringes of the main limestone bodies.</p>	<p>Support, through agri-environment schemes and catchment sensitive farming, the adoption of land management practises that minimise off site impacts, such as reducing nutrient inputs on land with high runoff potential, and improving soil structure to reduce soil erosion</p> <p>Identify point sources of pollution and promote management solutions such as reducing run off and reducing soil compaction.</p> <p>Establish riparian vegetation, including woodland, in areas of high erosion risk.</p> <p>Establish permanent grassland or other permanent vegetation alongside watercourses, especially in areas of soil and nutrient run off.</p> <p>Manage stock access to watercourses to minimise bare ground at risk of erosion.</p>	<p>Regulating water quality</p> <p>Biodiversity</p> <p>Regulating soil quality</p> <p>Regulating soil erosion</p> <p>Food provision</p>
	Woodlands					
	Wetlands					
	Permanent grasslands					
	Riparian vegetation					

⁸ Kent Leven Catchment Flood Management Plan: Summary Report, Environment Agency (December 2009; URL: www.environment-agency.gov.uk/research/planning/33586.aspx)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow	Rivers and streams	The great majority of the NCA falls within the Kent Leven catchment for flood management purposes whilst its south-eastern edge falls within the Lune catchment. These catchments have their headwaters in the Lake District and Howgill Fells which, with their impermeable geology, high rainfall and fast flowing rivers produce large amounts of rapid run-off.	Local	<p>The Environment Agency's preferred approach to managing the flood risk includes restoring natural flood plains and associated habitats (with benefits for biodiversity and sediment/pollutant control through reduced cross-land flows), encouraging take-up of Environmental Stewardship options to optimise land management for flood risk reduction, avoiding inappropriate development in flood risk areas and minimising run-off from new development, for example through inclusion of sustainable drainage systems.</p> <p>It is predicted that climate change impacts will result in more frequent and more intense storm events which has the potential to exacerbate issues associated with both fluvial and surface water flooding. Managing fluvial flooding through land management measures that reduce peak flows, de-synchronise peak flow times between different tributaries in the same river system and slow water flow speeds through catchments will all regulate water flow and can reduce river flooding. However these measures would need to be implemented in up-catchment NCAs.</p> <p>On flood plains and in the catchments of the Bela, Winster and Lyth both fluvial and surface water flooding occurs. Here, land management practises that slow surface water runoff, increase water infiltration and allow water storage on the flood plain could be adopted to slow river flows and help regulate flooding.</p>	<p>Seek opportunities to create more flood storage within flood plains, including restoring and expanding wetland habitats, thus improving infiltration rates and increasing storage capacity of flood waters.</p> <p>Seek opportunities to establish woodland and riparian vegetation alongside watercourses.</p> <p>Seek opportunities to manage grasslands to improve soil structure and encourage infiltration rather than runoff of surface waters.</p> <p>Restore areas of peat bogs to regulate water flow.</p> <p>Where there is local need for property protection or agriculture restore areas of flood plain habitat to act as rain water and/or flood storage areas.</p>	<p>Regulating water flow</p> <p>Biodiversity</p> <p>Regulating water quality</p> <p>Regulating soil quality</p>
	Grazing marsh and flood storage areas	The northern part of the Kent Leven catchment overlays the south and east of Cumbria High Fells NCA draining the southern fells of the Lake District, ultimately to Morecambe Bay. The NCA's main settlements experiencing river flood risk in this catchment are Kendal, and Ulverston. ⁹				
	Morecambe Bay and associated wetlands	Areas in the Lune catchment in this NCA are predominantly rural so there are no major settlements with fluvial flood risk. However, in the south-eastern part of the NCA in the Lune Catchment, Halton has significant flood risk. Downstream, in the Morecambe Coast and Lune Estuary NCA ¹⁰ flood risk 'hotspots' include Carnforth on the River Keer and the Borough of Lancaster City on the River Lune. Management in this NCA will affect water flow downstream.				
	Woodlands					
	Other semi-natural habitats					

⁹ Kent Leven Catchment Flood Management Plan: Summary Report, Environment Agency (December 2009; URL: www.environment-agency.gov.uk/research/planning/33586.aspx)

¹⁰ Lune Catchment Flood Management Plan: Summary Report, Environment Agency (December 2009; URL: www.environment-agency.gov.uk/research/planning/33586.aspx)

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Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow continued				<p>...continued from previous.</p> <p>Away from the reclaimed flood plains the land is largely underlain by free draining Limestone. Normally there is limited surface runoff from these areas onto the flood plain, however, during peak rainfall episodes there may be some surface runoff, at these times vegetation cover on the slopes will slow water flow and aid infiltration.</p> <p>Many of the regulatory measures influencing river flooding are those that enhance other services such as soil quality, prevention of soil erosion and improving water quality. For example restoration of wetland habitats to regulate water flow can simultaneously benefit biodiversity (by creating habitats), improve water quality (by preventing sediment entering watercourses) and benefit soils (by trapping sediments and nutrients).</p>		

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil quality	<p>Trees, woodland and scrub</p> <p>Lowland raised mires and other wetland peat habitats</p> <p>Permanent grassland</p> <p>Coastal grazing marsh</p>	<p>This NCA has 9 main soilscape types:</p> <ul style="list-style-type: none"> ■ Freely draining slightly acid loamy soils, covering 33 per cent of the NCA. ■ Freely draining slightly acid but base-rich soils (24 per cent). ■ Slowly permeable seasonally wet acid loamy and clayey soils (15 per cent). ■ Loamy and sandy soils with naturally high groundwater and a peaty surface (15 per cent). ■ Raised bog peat soils (4 per cent). ■ Salt marsh soils (3 per cent). ■ Freely draining acid loamy soils over rock (2 per cent). ■ Very acid loamy upland soils with a wet peaty surface (2 per cent). ■ Loamy and clayey soils of coastal flats with naturally high groundwater (1 per cent). 	Local	<p>Common issues across soil types affecting soil quality include compaction, declining content of organic material and fertility, and loss of structure. Compaction arises from stock and machinery movement, particularly on wet soils, and especially in association with a reduction in soil fauna. The loss of soil fauna derives from artificial and slurry inputs that have the effect of shifting soil ecosystems from fungus based systems to bacterial based systems and can lead to direct loss of key species.</p> <p>Organic material loss results from soils not being allowed to sequester carbon from vegetation, while fertility loss results from the loss of soil carbon and nitrogen reserves. The management consequence of these changes is often an increased reliance on artificial inputs to maintain agricultural productivity despite falling soil quality. These issues will be most strongly felt in the reclaimed soils of grazing marshes where soils are most prone to waterlogging and have naturally high carbon contents.</p> <p>Addressing these issues to restore and improve soil quality requires an integrated move to more sustainable management of pastoral systems and is likely to require the integration of a number of different measures, including a reduction in soil nutrient loading and decreasing the need to spread waste on damaged soils; use of legumes to fix nitrogen to maintain fertility with decreased reliance on artificial inputs, decreasing stock numbers to allow some annual productivity to be integrated into soils and decreasing compaction risk, and adapting stock management to avoid areas of sensitive soils compaction risk.</p> <p>Actions to improve soil quality and improve their structure would have wider benefits, for example, improving regulation of water flow by enhancing water infiltration, reducing the risk of soil erosion and improving water quality by lessening surface runoff improving biodiversity and securing long-term food provision. This could most directly be achieved by allowing a component of annual productivity to be to be re-integrated into the soil structure.</p>	<p>Work with land owners to promote sustainable farming practices to improve the organic matter content and structure of agricultural soils and protect soil biodiversity.</p> <p>Protect and enhance salt marshes to develop new soils.</p> <p>Identify and apply grazing regimes that increase sward diversity and increase the deposition and overall levels of organic matter. Manage with extensive grazing regimes to reduce stocking densities and avoid soil compaction. Avoid compaction through unnecessary machinery use particularly during protracted periods of wet weather.</p> <p>Work with the farming community to promote good nutrient and land management practise.</p> <p>Implement measures to reduce diffuse pollution from land management.</p>	<p>Regulating soil quality</p> <p>Regulating soil erosion</p> <p>Regulating water quality</p> <p>Biodiversity</p>

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Regulating soil erosion	Semi-natural vegetation cover	84 per cent of soils in the NCA are susceptible to erosion.	Regional	<p>With the exception of the freely draining slightly acid loamy soils, of which a proportion are cultivated and therefore at risk from wind erosion, most soil erosion is likely to involve water erosion. With pastoral management being dominant much erosion is likely to be associated with stock management.</p> <p>Riparian vegetation, including woodland, can help manage soil erosion by trapping sediments being carried by surface waters before they are lost to watercourses.</p> <p>Principal opportunities may lie around influencing stock management around areas with high soil erosion risk and where soils are prone to compaction. The low extent of cropped land in the NCA will mean regulating soil erosion by limiting exposure of bare ground.</p> <p>Areas of soil loss are likely to be associated with compacted and waterlogged soils and along watercourses. Should the proportion of pasture decrease in the future as a consequence of changing farming economics then there may be increased risks, particularly on the mineral soils of the NCA where conditions are most suitable for crop growing. Here areas on the slopes of drumlins may be particularly at risk of soil loss.</p>	<p>Maintain pastoral systems on areas of high erosion risk.</p> <p>Work with the farming community to adapt to sustainable land management regimes, including management of grazing levels around erosion points and allowing some annual growth to be incorporated back into soils.</p> <p>Establish vegetation along riparian corridors to trap sediment, reduce sediment transport rates and reduce erosion risk.</p>	<p>Regulating soil erosion</p> <p>Water availability</p> <p>Climate regulation</p> <p>Regulating soil quality</p> <p>Regulating water quality</p> <p>Regulating water flow</p> <p>Biodiversity</p>
	Wetland habitats	The freely draining slightly acid loamy soils (33 per cent) associated with areas of glacially deposited materials can erode easily on steep slopes, especially where vegetation is removed, soil is compacted or where organic matter levels are low after continuous cultivation.				
	Permanent grasslands	<p>The loamy and sandy soils with naturally high groundwater and a peaty surface (15 per cent) which are associated with the margins of the area in the Lune catchment and raised bog peat soils are at high risk of wind erosion, especially where surfaces are bare.</p> <p>Salt marsh soils (3 per cent) may be lost to coastal erosion, including from sea level rise.</p>				

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pollination	<p>Semi-natural vegetation</p> <p>Orchards</p>	<p>The considerable areas of heathland, wetlands and unimproved grasslands of this NCA provide important habitat for the insect communities important for pollination.</p> <p>In many areas fruit trees, in orchards or as hedgerow standards, are removed from the areas of semi-natural habitat the best support healthy pollinator populations.</p>	Regional	<p>With the exception of orchards there is low dependence on pollinator services from the agricultural sector in this NCA, as the agriculture is predominantly pastoral at the current time.</p> <p>The extensive presence of semi-natural habitats in the NCA will support pollinating species.</p> <p>Improving the condition of hedges and orchards by gapping up and replacing dead trees, and establishing management regimes that allow trees to flower would increase pollination resource but also improve connectivity between more extensive areas of habitat and benefit sense of place and history experience, particularly in areas such as the Lyth Valley which are associated with traditional damson orchards.</p>	<p>Maintain SSSI in favourable condition to prove nectar resource through the flight season.</p> <p>Enhance the quality of priority habitats including coastal and flood plain grazing marsh and traditional orchards.</p> <p>Seek opportunities to improve the condition management of boundary features such as hedges and vegetation buffers to provide pollen and nectar sources.</p>	<p>Pollination</p> <p>Biodiversity</p> <p>Regulating water quality</p> <p>Regulating soil quality</p> <p>Regulation of soil erosion</p> <p>Sense of place / inspiration</p> <p>Sense of history</p>

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating coastal erosion and flooding	<p>The intertidal zone and estuaries</p> <p>Coastal transitional habitats including limestone cliffs, salt marshes and mudflats</p>	<p>This section of coast includes a large area of the Morecambe Bay system, characterised by extensive sand flats that become exposed at low tide.</p> <p>Various channels cut across these sand flats and the dynamic meandering of these is an important influence upon patterns of shoreline erosion and accretion.</p> <p>This NCA forms part of 'sub-cell 11c' of the Shoreline Management Plan 2 (SMP2). See: http://mycoastline.org/index.php/shorelinemanagement/smp2 for more information.</p> <p>Coastal habitats in the NCA, in particular the extensive salt marshes, regulate tidal impacts on the adjacent land. By binding soils they limit erosion, by trapping sediments they increase land levels along the margins of the bay, and through salt marsh vegetation they dissipate tidal energy. These processes all protect adjacent terrestrial areas from flooding and erosion.</p>	Regional	<p>The movement of channels in the Kent, Leven and to a lesser extent the Keer estuaries exert a significant control on the behaviour of adjacent shorelines. The entire bay-frontage of the NCA is part of a single sediment system shared with adjacent NCA's bordering the bay. Sediments are brought to the bay by the various river systems and from seaward sources then reworked with in the bay by the tides.</p> <p>The impacts of climate change with increased sea levels, increased storm events and increased river flows associated with high rainfall events will all impact on the coastal margin.</p> <p>Across all these areas salt marshes provide the front line of coastal defence. Sensitive managed salt marshes, play a major role in managing coastal flood risk by trapping and binding sediments in front of sea defences leading to increased land levels and stability, and by reducing tidal energy levels. With sea level rise a potentially significant issue in this NCA, these services can play a significant role in regulation of coastal erosion. At present the majority of coastal defences in the NCA are fronted by salt marshes, including all the stretches where the railway embankment acts as the primary sea defence.</p> <p>As well making an important contribution to coastal flood defence salt marshes regulate coastal erosion, are important nursery areas for fish, are a biodiversity asset, and are a source of income for land managers. They are also part of the cultural identity of the NCA.</p>	<p>Seek realignment opportunities along the reclaimed coast of the Kent Estuary and Cark areas.</p> <p>Maintain a dynamic coastal environment.</p> <p>Seek opportunities to make farmland more robust to future climate change impacts, for example by adopting regulated tidal exchange technology, thereby enabling the raising of land levels landwards of existing coastal defences without increasing flood risk.</p>	<p>Regulating coastal erosion and flooding</p> <p>Biodiversity</p> <p>Food provision</p> <p>Sense of place / inspiration</p> <p>Sense of history</p>

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of place/ inspiration	Limestone escarpments and exposed limestone pavement	The quality of the landscape is reflected in the high coverage (38 per cent) of designated landscape in the NCA. This includes both the Arnside and Silverdale AONB and the Lake District National Park, and a small part of the Forest of Bowland.	National	<p>Feelings of inspiration and escapism are likely to be associated with the contrasting landscape ranging from the impressive limestone hills rising above low-lying pastures and wetlands with the open, low-lying salt marsh and coastal landscapes. The long views varying from extensive, spectacular and panoramic, to more intimate and small scale, add to the sense of place and inspiration.</p> <p>Each component habitat of the landscape lends its individual character to the distinct local landscape with groups of species not found in adjacent areas. For many habitats this reflects long tenures of relatively unmodified management practises. Maintaining this distinctiveness of individual character is dependent on securing management that mimics the processes that have lead to the development of the particular communities. This is mirrored in the distinctive settlement character with scattered small villages nestled into the landscape with buildings of local limestone, roofs of lake district slate and remnant fruit trees survivors of former orchards.</p> <p>The sense of place is then enhanced by the way the individual semi-natural communities, and the distinctive local settlements, relate to each other with the different communities. Each feature, in its own right distinctive, sit alongside each other often in tight mosaics (particularly in the Arnside and Silverdale AONB).</p>	<p>Maintain open views across bay and into the uplands of Cumbria, the Yorkshire Dales and Bowland.</p> <p>Seek opportunities to record and protect cultural heritage and experiences, including access to sites.</p> <p>Seek opportunities to restore field boundaries, and maintain relationship between boundary type and local surface geology.</p> <p>Seek opportunities to maintain, restore and enhance the key habitats of the NCA.</p> <p>Seek opportunities to embed local vernacular styles in developments.</p> <p>Seek opportunities to encourage appropriate access to natural environments, and to promote the calming and restorative effect that contact with tranquil and sensory environments have on health and wellbeing.</p>	<p>Sense of place/ inspiration</p> <p>Biodiversity</p> <p>Sense of history</p> <p>Regulating water quality</p> <p>Tranquillity</p> <p>Recreation</p> <p>Geodiversity</p>
	Morecambe Bay	Sense of place is provided by the characteristic sweep of Morecambe Bay with its extensive sand flats and long, open views and important habitats.				
	High quality semi-natural habitats	High quality semi-natural habitats include limestone pavements, herb-rich grasslands, species-rich scrub, raised bogs and native broadleaved woodland often juxtaposed or woven in tight mosaics. Also sand flats and expanses of salt marsh constantly changing with the tide, and both fluvial and estuarine water systems.				
	Fluvial and estuarine water systems	Long and expansive views for the limestone hills and over the flat, low-lying coastal landscape and inland, gently undulating hills divided by shallow valleys.				
	Sand flats and expanses of salt marsh					
	Long and expansive views					
	Inland, gently undulating hills divided by shallow valleys					
Local limestone used extensively in building and drystone walls						
				Continued over...		

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of place/ inspiration continued				<p>...continued from previous.</p> <p>At the largest scale the sense of place is then framed by the surrounding landscape, visible from the coastal headlands and the summits of the limestone plateaus. Here the interwoven landscape of coast, limestones, wetlands and rural settlements can be seen in its place bordered to the west by the dynamic expanse of Morecambe Bay and in the other directions by the uplands of the Lake district, the Yorkshire Dales and the Bowland Fells. All designated upland landscapes in their own right.</p> <p>This NCA's sense of place is core to it having large parts designated as AONB and National Park.</p> <p>The desirability of experiencing the high quality landscape through quiet recreation provides many opportunities to improve health and well being.</p>		

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	<p>Stone circles, stately homes, fortified farmsteads, lime kilns and Second World War airfields</p> <p>Vernacular building materials, styles and settlement pattern</p> <p>Experience of traditional practises</p> <p>5 registered parks and gardens covering 333 ha</p> <p>74 scheduled monuments</p> <p>762 Listed Buildings</p>	<p>Particular archaeological features contributing to the landscape's early sense of history include burial mounds and stone circles, largely located on higher ground such as Dogholes Cave near Silverdale; prehistoric settlements and enclosures on Birkrigg Common and medieval field patterns particularly around the villages of Great and Little Urswick.</p> <p>Prominent local buildings including pele towers at Hampsfell, Arnside, Hazelslack, and Beetham are generally in poor condition but are reminders of periods of warfare. The suite of stately homes both emphasise the local importance of the estate-owned landscape and individually reflect the building styles of different periods of history. Generally these stately homes are in good condition. Other prominent features include the recently restored Hoad Monument overlooking Ulverston.</p> <p>The history of the landscape is further reinforced by its generally dispersed rural settlement pattern with individual farmsteads, hamlets and nucleated centres often constructed in characteristic local limestone with slate roofing, giving a visual coherence to the older parts of these settlements.</p> <p>Across the NCA a sense of history is also provided by the evident link in 'traditional' land management practises and industrial remains, such as coppice management of woodland and lime kilns, to the historic social and cultural environment.</p> <p>Second World War Cark Airfield near Flookburgh was designed as a wartime fighter aerodrome and is still operational as a private airfield today.</p>	National	<p>The six sites currently considered 'at risk' by English Heritage in the NCA reflect a range of aspects of the area's history. They include pele towers, industrial sites such as a potash kiln and gunpowder works, a church and the bridge crossing the River Lune at Kirby Lonsdale. All these sites are buildings which require stabilisation to prevent ongoing decline in condition that may lead to eventual collapse. These sites are all also prominent features in the built historic landscape and their loss would impact on the sense of history apparent in the NCA landscape.</p> <p>Most sites representing the built historic environment, such as the stately homes, are in use and many sites have undergone restoration programmes in recent years ensuring protection in the short-term at least.</p> <p>With much of the NCA covered by designated landscape designations the importance of maintaining cultural assets and vernacular style in relations to developments is recognised in planning affording some security of continuity into the future. However, planning policy may deviate from historic patterns of evolution of the cultural landscape, for example favouring of development within settlement boundaries, which may affect the sense of history afforded by the structure of the cultural landscape.</p> <p>Although some traditional land uses have declined, such as small-scale quarrying for lime, making a break from historical management of the landscape other such as coppicing continue, albeit to new markets.</p>	<p>Promote, protect and manage, where appropriate, the visible historic features of the built landscape such as stone circles, hill forts, fortified farmsteads, lime kilns, historic buildings.</p> <p>Promote traditional skills and to raise awareness of the role history has played in developing and maintaining the distinctive qualities of the landscape.</p> <p>Seek opportunities to promote land use in keeping with the cultural development of the landscape, such as coppice management.</p> <p>Encourage the use of vernacular building styles including local limestone and Lake District slate as building materials.</p> <p>Seek opportunities to record sites at risk from coastal change. Provide interpretation and educational opportunities to allow visitors to understand, value and enjoy the historic features of the NCA.</p>	<p>Sense of history</p> <p>Sense of place / inspiration</p> <p>Biodiversity</p> <p>Geodiversity</p> <p>Recreation</p>

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Tranquillity	<p>Coastal landscape</p> <p>Rural landscape</p> <p>Woodlands</p> <p>Open fells and limestone escarpments</p>	<p>Characteristics of the landscape that are particularly important in conveying a sense of tranquillity are the limestone hills, widespread semi-natural deciduous woodland nestling in sheltered valleys, unimproved limestone grasslands, undeveloped sections of coastline and expansive views across sand flats.</p> <p>Generally tranquillity levels are relatively high, with the main area of low tranquillity around the M6 with other areas of low tranquillity around Grange-Over-Sands and the outskirts of Ulverston.</p>	National	<p>The NCA has experienced a significant decline in tranquillity since the 1960s. Undisturbed areas have decreased from 84 per cent in the 1960s to 49 per cent in 2000, closely linked to the upgrading of the transport network including the M6 in 1970 and more recent upgrades to the A590 and A591.</p> <p>The principal features that have been identified as contributing to a sense of tranquillity are all key attributes of this NCA and contribute to its sense of place. Management to enhance these features will generally benefit the sense of tranquillity and vice-versa. Areas where tranquillity is reduced are particularly associated with settlements and major roads.</p> <p>Encouraging programmes which aim to enhance the special features of this landscape and its sense of place will help maintain its sense of tranquillity. Where potential exists for mitigating the impacts of development in a manner consistent with the character of the NCA these may help reduce the loss of tranquillity.</p>	<p>Maintain the quiet and intimate landscape of the Arnside and Silverdale AONB.</p> <p>Maintain areas of high tranquillity including undeveloped coastal areas and the expansive uninterrupted views from limestone hills.</p> <p>Seek opportunities to enhance the rights of way network for quiet enjoyment of the landscape.</p> <p>Manage developments to reduce disturbance and further loss of tranquillity.</p> <p>Promote the calming and restorative effect that contact with tranquil and sensory environments has on people's health and wellbeing.</p>	<p>Tranquillity</p> <p>Sense of place / inspiration</p> <p>Sense of history</p> <p>Biodiversity</p> <p>Geodiversity</p>

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation	<p>Extensive rights of way and open access routes</p> <p>Cycle routes</p> <p>Cultural and historical heritage and the designated landscapes</p> <p>Access and recreation opportunities around the coastline of Morecambe Bay</p>	<p>Rights of way network totalling 567 km at a density of just less than 1.5 km per km².</p> <p>Areas of open access land covering 6.7 per cent of the NCA, supplemented by areas of permissive access including a network of nature reserves.</p> <p>National cycleways which cross the area.</p> <p>The dynamic coastline of the bay, providing extensive views, fishing and historical cross bay walks.</p>	National	<p>Recreation is important in this area both in its own right and as a component of the local sense of place and economy. Recreation plays an important role in the designated landscapes, supports the strong sense of place, and supports significant visitor economy through the link to the cultural, historical and natural attributes of the landscape. The network of public rights of way is enhanced by a suite of sites such as nature reserves and National Trust land which provide additional access and recreation opportunities.</p> <p>Cross Bay walks led by the appointed guides of the sands are a common summer event, often organised as charity fundraisers and attracting visitors from outside the area. These walks, following the traditional crossing points on the sands of the estuaries are a direct link to the NCA's past and act as a reminder that from at least Roman times until the 1820s crossing the bay was the most direct transport route into South Cumbria. Visitors also come to the area for opportunities for birdwatching, angling, walking and to enjoy the tranquillity of the NCA.</p> <p>The area also supports some aviation based recreation including parachuting and gyrocopter flying which by virtue of being highly apparent have the potential to impinge on tranquillity.</p> <p>Field sports including deer stalking, salmon fishing and wildfowling are all undertaken in the NCA, and are generally linked to areas of semi-natural habitat with low levels of disturbance from walkers. Under appropriate management some field sports support other services. Supporting measures that look to manage recreation in a manner that is sympathetic to the key attributes of the NCA and ensure recreation that carries the risk of high impact is managed to avoid negative impacts.</p>	<p>Maintain, promote and manage public rights of way, recreational facilities and sites associated with cultural, historical and natural heritage as key attractions for visitors.</p> <p>Promote informed, environmentally sensitive recreation particularly in the coastal zone where pressure is high and many features, for example the wildlife, are sensitive to disturbance.</p> <p>Promote the value of a high quality environment to increase awareness of its importance as an economic asset.</p> <p>Develop opportunities to provide interpretation of the landscape and its many features, enabling residents and visitors to understand, value and enjoy its character.</p> <p>Develop the network of National and Regional Cycle Routes crossing the NCA, to provide alternative recreational opportunities for users, linking coastal attractions with the wider local environment, and supporting the development of a green visitor economy.</p> <p>Support actions to improve access to the local environment for recreation and outdoor education close to where people live and work, allowing local communities to enjoy their environment, and to benefit from the health and social rewards it affords them.</p> <p>Develop opportunities to work with commerce to support initiatives promoting sustainable tourism and that help grow a local green economy, recognising the value to the local economy that recreational visitors bring to the NCA.</p>	<p>Recreation</p> <p>Sense of place / inspiration</p> <p>Biodiversity</p> <p>Food provision</p> <p>Sense of history</p> <p>Tranquillity</p> <p>Geodiversity</p>

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity	<p>Priority habitats</p> <p>Limestone pavement</p> <p>5 SAC, 2 SPAs, 2 Ramsar sites and 7,000 ha of SSSI</p> <p>212 Local Wildlife Sites</p> <p>Other habitats / land cover where there is potential for change / enhancement</p>	<p>The limestone massifs of the NCA support a range of habitats of international importance including limestone pavement, limestone grasslands and a range of woodland types, often present in tight mosaics, particularly on slopes, around Grange-over-Sands and in the Arnside and Silverdale AONB.</p> <p>Limestone pavement is the premier limestone habitat with the NCA making a significant contribution to the global resource. Although much reduced in area by past extraction (for building, industry and garden landscaping) almost all the remaining resource is protected by SSSI (geological and biological) and Limestone Pavement Orders. The pavements support a notable assemblage of plants including rigid buckler fern, dark-red helleborine, and angular Solomon's seal.</p> <p>In areas of shallow soils on limestone, species-rich grasslands have developed, managed as pastures. Although many have been lost through agricultural improvement there are still areas of quite extensive unimproved pasture, often characterised by the presence of colonies of yellow meadow ant. These unimproved grasslands are characterised by the presence of blue moor grass, forming a community restricted to the limestones of northern England as well as supporting species such as the Scotch argus butterfly at the southern limit of its range and the nationally declining northern-brown argus.</p> <p>Native woodland on the limestone includes both coppiced and 'high forest' stands as well as species rich scrub communities. Managed native woodland is associated with past coppicing and is dominated mainly by birch, ash and hazel but with a wide mix of other woody species including small-leaved lime and field maple at the northern edge of their native ranges. Managed woodland is also associated with some of the particularly notable fauna of the NCA including high brown fritillary, pearl-bordered fritillary and Duke-of-Burgundy butterflies, dormice, lesser-spotted woodpecker and marsh tit.</p> <p>Continued over...</p>	International	<p>The biodiversity attributes of the NCA are highly varied and most instances include sites of national and international importance.</p> <p>Of the SSSI series 85 per cent is in favourable or unfavourable recovering condition while 15 per cent is in unfavourable no change or declining condition.</p> <p>The documented declines and in some case loss of a number of specialist species from a range of habitats indicates many habitats being in sub optimal condition.</p> <p>The recent colonisation of the area by a number of species, apparently in response to climate change, indicates a change in base state of the environment which will modify the biodiversity resource in the future.</p> <p>The threats to the integrity of the various key habitats are varied, as are the potential management measures to offset the threats.</p> <p>Some key issues include:</p> <ul style="list-style-type: none"> ■ Diffuse pollution which threatens the suite of freshwater sites, ■ Under-grazing and neglect which threaten the open limestone grasslands, ■ Over management or abandonment of formerly managed woodlands which would threaten species associated with established woodland cover or open woodland glades respectively. ■ Increased deer populations which threaten woodland regeneration by browsing off ground flora and young saplings. ■ Increases in non-native invasive species including both grey squirrel and signal crayfish which threaten their native cousins through disease, and species such as cotoneaster, buddleia and Himalayan balsam which threaten native vegetation. ■ Novel plant diseases threaten species such as ash, one of the dominant woodland tress, and juniper. <p>Continued over...</p>	<p>Protect, restore and enhance areas of semi-natural habitat of all types, but with particular reference to limestone pavements and grasslands, native woodland, lowland raised bogs and other wetlands, salt marshes and traditional orchards.</p> <p>Promote businesses, including wood fuel and those marketing coppice products, to support active management of woodland.</p> <p>Support the production and marketing of agricultural products that support the management of semi-natural habitats in good condition.</p> <p>Enhance awareness of the biodiversity value of the NCA and the ecosystem services provided by the maintenance of biodiversity in good condition. Protect the area from invasive non-native species and their impacts, and manage the impacts of species freed from population regulation pressures.</p>	<p>Biodiversity</p> <p>Climate regulation</p> <p>Food provision</p> <p>Regulating water flow</p> <p>Regulating water quality</p> <p>Regulating coastal erosion and flooding</p> <p>Sense of place / inspiration</p> <p>Tranquillity</p> <p>Recreation</p> <p>Geodiversity</p>

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
		<p>...continued from previous.</p> <p>The scrub communities present in the woodland mosaic and on the fringes of extensively grazed pastures, often on the thinner soils, are an important feature in their own right and include species such as Lancastrian whitebeam, endemic to this NCA.</p> <p>Although much more localised in extent, the limestone geology also supports some important wetland habitats including limestone springs, calcareous fen, and the marl lakes at Hawes Water and Cunswick Tarn.</p> <p>Though much reduced in extent the suite of surviving lowland raised mires in the NCA are amongst the most extensive and highest quality in England and remain an important refuge for species such as white-faced darter, large heath butterfly, bog brush cricket and tree pipit.</p> <p>The reedbed at Leighton Moss is notable as an isolated but extensive example of the habitat and supports isolated populations of a number of reedbed specialist species including bittern, marsh harrier, reed warbler and bearded tit.</p> <p>Across the suite of key habitats in the NCA many species have experienced serious declines reflecting declines in habitat quality. A number of species which were formerly common within the NCA are now restricted to a few sites and a number of butterflies, such as the small blue and the silver-studded blue, are extinct in the NCA.</p> <p>A number of other priority habitats are present in the NCA such as rivers and fens, and include culturally important habitats such as hay meadows, parklands and orchards; however, they are more limited in extent and or condition. They nonetheless support a wide range of priority species from sea lamprey to hairy click-beetle.</p> <p>Some habitats are threatened by invasive non-natives in particular Himalayan balsam along watercourses, signal crayfish in the rivers and cotoneaster on exposed limestone sites.</p>		<p>...continued from previous.</p> <ul style="list-style-type: none"> ■ Human modification of habitats remains a direct threat for many systems dependant on low nutrient conditions such as species-rich grasslands, and drainage sensitive areas of wetland while successional change following modification is causing the continued decline of many areas of lowland raised bog. ■ Climate change poses an ongoing risk to many habitats through changing the limits of environmental condition ■ Increased levels of recreational disturbance threaten a number of species such as waders. <p>Addressing these risks will necessitate a varied and integrated approach to the management of the biodiversity of the NCA both inside and outside the designated site series.</p> <p>Key actions include the development of sustainable woodland management programmes that deliver economic outputs alongside biodiversity; management of nutrients and soils on farmland so that they are not lost into watercourses; removal of secondary scrub and the restoration of the hydrology of lowland raised mires; prevention of nutrient loading on unimproved grasslands; continued monitoring and management of invasive species and new diseases; managing disturbance around sensitive sites; bringing neglected sites back into positive management; promotion of the biodiversity of the area as a key asset and increasing awareness of best practise.</p> <p>Where sites have been restored, but where component species are unlikely to recolonise because of site isolation, actions to redress will need to be identified and actioned. This may include steps to improve local habitat connectivity to enable recolonisation or species reintroduction.</p>		

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	<p>Limestone bedrock, hills, scree and pavements</p> <p>Peat bogs of the coastal plain</p> <p>Dynamic geomorphological processes within the bay</p> <p>5 geological SSSI and 3 mixed interest SSSI</p> <p>27 local sites within the NCA</p> <p>5 Local Nature Reserves with geological interest</p>	<p>Limestone pavements have undergone a serious decline from original extents linked to their use in building and landscaping, however, the remaining resource is now protected by Limestone pavement orders.</p> <p>The Holkerian Limestone exposures take their name from the NCA where the type locality is located and have lent the name to the associated geological period.</p> <p>Peat forming bogs and dynamic intertidal environments are both examples of dynamic geomorphological processes, with the former also maintaining an important palaeo-environmental record. Generally peat bogs are in declining condition due to past exploitation and consequent degradation, though some sites are now being restored. The functioning of the intertidal environment is less damaged though there has been localised degradation through agricultural management and system constraint by land reclamation, leaving smaller extents subject to more dynamic change.</p>	National	<p>The underlying geology creates a landform of gentle coastal and glacial derived lowlands interspersed with rugged limestone massifs. In the past the limestone has also had a significant role in shaping the development of the cultural landscape by providing building materials and the raw-materials for the lime industry.</p> <p>The resource of limestone pavement in the NCA is of national significance, making up a significant proportion of the national and global resource. As well as being geologically unique, these pavements are an important biodiversity asset, and support a notable assemblage of species.</p> <p>The lowland raised bogs of the NCA also make a significant contribution to the national and international resource.</p> <p>Supporting opportunities to restore peatlands to re-establish their geomorphological function as a recorder of paleo-ecological change will also restore their biodiversity and carbon sequestering role. Similarly supporting the continued geomorphological function of salt marshes will support their biodiversity and maintain their carbon sink function.</p>	<p>Protect and maintain areas of limestone pavement.</p> <p>Continue to maintain views of geological features and exposures. Improve access to exposures, cuttings and quarries, where appropriate, for the enhanced understanding of geodiversity.</p> <p>Conserve and enhance geological SSSI and Local Geological Sites, to promote and interpret the geodiversity of the NCA, and to increase people's engagement, understanding and enjoyment of the geological heritage.</p> <p>Support opportunities to restore peatlands to re-establish their geomorphological function as a recorder of palaeo-ecological change; this will also restore their biodiversity and carbon sequestration role.</p> <p>Protect salt marshes from modification and where possible increase their extent and quality.</p> <p>Seek opportunities to raise awareness of the services provided by dynamic geomorphological processes.</p>	<p>Geodiversity</p> <p>Sense of place / inspiration</p> <p>Sense of history</p> <p>Regulating water quality</p>

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Front cover: View from Arnside Knott to Whitbarrow over Morecambe Bay.

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