National Character Area profile:

17: Orton Fells

Supporting documents

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Introduction

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

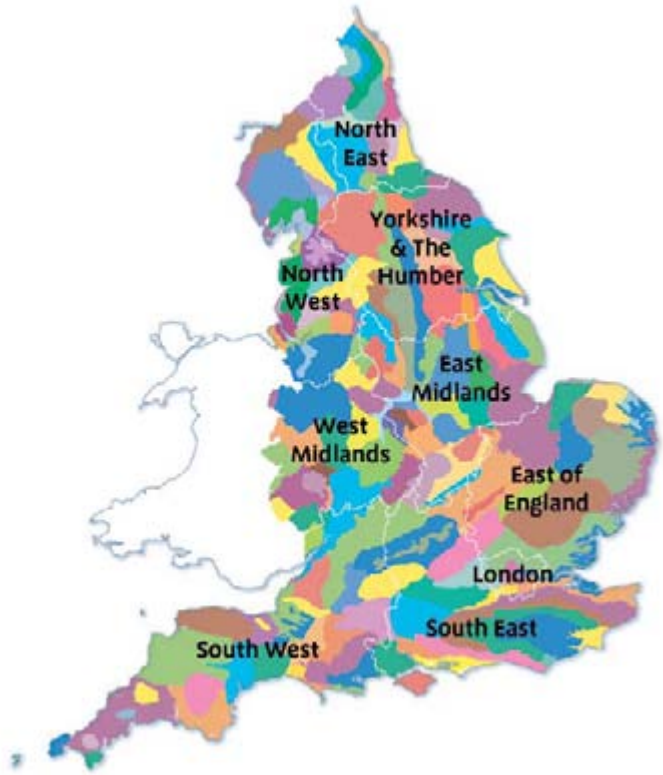
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and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

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

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

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

National Character Areas map



[1] The Natural Choice: Securing the Value of Nature, Defra (2011; URL: www.official-documents.gov.uk/document/cm80/8082/8082.pdf)
[2] Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services, Defra (2011; URL: www.defra.gov.uk/publications/files/pb13583-biodiversity-strategy-2020-111111.pdf)
[3] European Landscape Convention, Council of Europe (2000; URL: http://conventions.coe.int/Treaty/en/Treaties/Html/176.htm)

Summary

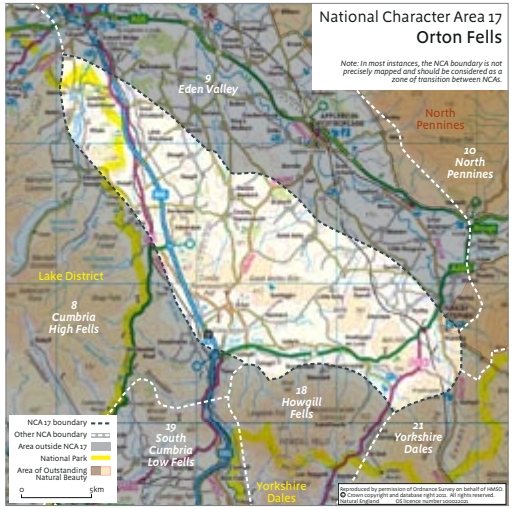
The Orton Fells National Character Area comprises a limestone plateau with a complex mix of limestone pavements, upland heath, and calcareous and acid grassland. The fells are open, exposed and sweeping, with long-distance panoramic views out to the skylines of the adjacent uplands – the Cumbria High Fells, the Howgills, the Yorkshire Dales and the North Pennines. Nine per cent of the NCA lies within the Lake District National Park.

The Asby Complex is an extensive Special Area of Conservation (SAC) designated for its karst features, particularly its long stretches of limestone pavement as well as its mix of acid and alkaline habitats; part of the SAC is also designated as a National Nature Reserve (NNR). Smardale Gill, with its ash woodlands and calcareous grasslands that support outstanding butterfly populations, is likewise designated as an SAC and an NNR. The predominant land use is livestock rearing, with some dairy farms, so that along with the rough grazing there are extensive managed grasslands in pastures and meadows defined by drystone walls on lower-lying land. Some of the best upland hay meadows can be found here, together with wide species-rich verges along the quiet straight roads, making it an exceptional experience to travel through the area.

On the higher land there are occasional ash trees, as well as copses sheltering the dispersed farmsteads. Otherwise woodland cover is low, with upland ash woodlands largely restricted to the steep sides of lower valleys, and small shelterbelts including conifers, especially in the north. There are few settlements, making it a very quiet rural area, with the exception of one main north–south transport corridor of motorway, roads and rail in the west. With little development over time, the farmsteads and small villages have a high degree of historical integrity and visual unity, as they are built of local stone. There are also many archaeological features and earthworks, making it a very rich historic environment. There is plenty of scope for quiet recreational use, such as walking, cycling, riding, wildlife watching and angling, and interpretation of the area's rich geological and heritage assets would increase its interest and enjoyment by residents and visitors alike.

Several tributaries of the River Eden rise here and flow down through narrow valleys and, as they flow over both limestone and sandstone, they comprise a range of habitat types that support diverse plant and animal communities, warranting their SAC designation. The River Lune is also of good quality and offers good angling opportunities.

With some soils vulnerable to compaction and erosion, some of the main issues to address here are the management of grazing to avoid poaching and trampling of river banks, and managing riparian buffers to capture sediment and nutrient run-off. The storage and application of fertilisers, slurry and manure also need to be carefully handled to avoid compaction and nutrient run-off. Ensuring that the upland heath and other habitats on the fells are in good condition will also assist with improving water quality, reducing soil erosion and reducing downstream flood risk.



Click map to enlarge; click again to reduce.

Statements of Environmental Opportunity

SEO 1: Conserve, manage and enhance the open fells on the limestone plateau, with their mix of karst features, upland heath, and calcareous and acid grasslands, for their inspirational and recreational values and their international biodiversity and geodiversity interest, improving water quality and mitigating climate change effects.

SEO 2: Manage and enhance the enclosed farmland with its diverse pastures, leys and meadows, dispersed farmsteads and quiet villages, strong field patterns and drystone walls, and species-rich road verges, to maintain livestock and dairy farming, the soils, and the sense of place and history, and to enhance its landscape character and biodiversity value.

SEO 3: Manage farmed land and semi-natural habitats to protect and improve the condition of the streams and rivers, enhancing their ecological value and water quality, strengthening the contribution they make to the local landscape and providing high-quality angling and wildlife-watching opportunities.

SEO 4: Identify, protect and interpret geological and historic features and encourage quiet recreation focused on enjoyment and appreciation of these features within the landscape.

The limestone plateau of the Orton Fells is open and expansive, largely treeless except for steep slopes and copses by the isolated farmsteads. Farms are located within groups of meadows and pastures, defined by drystone walls, and the use of local limestone creates a strong visual unity.

Description

Physical and functional links to other National Character Areas

The Orton Fells National Character Area (NCA) comprises a distinct tilted upland plateau of limestone upland, mostly between 180 m and 300 m in elevation, with its highest point at 412 m. This open upland plateau is separated by valleys from the surrounding uplands, and there are striking views out in all directions, to the Cumbria High Fells to the west, the Howgills to the south, Mallerstang and the Yorkshire Dales to the south-east and the North Pennines to the east and north-east.

The plateau of the Orton Fells forms the watershed between the rivers Eden and the Lune. The River Eden flows north through Mallerstang on the east side, then turns to flow north-west down the wide valley to the north of the Orton Fells. Several small rivers, including the Lowther, Lyvennet, Hoff Beck and Scandal Beck, rise from the watershed formed by the underlying limestone and flow north and north-east through narrow valleys before joining the River Eden, which flows north-west to Carlisle and the Solway Firth. The River Eden and its tributaries are designated as a Special Area of Conservation (SAC) for their freshwater habitats. A few smaller rivers flow south from the watershed to join the River Lune, which flows from east to west along the south of the area.

Along the west side of the Orton Fells is a nationally significant transport corridor which contains the A6, the M6 and the West Coast Main Line railway, all running north–south and linking England with Scotland. The A685, which runs across the south of the area, provides a link to this transport corridor across the uplands of the Pennines to the east.

Trees clustered around the historic village of Orton which lies within a long established pattern of meadows and pastures defined by drystone walls. In the distance is the Whinash Ridge within the Cumbria High Fells.

Key characteristics

- Wide, open and sweeping upland landscape with extensive limestone pavements, outcrops, heather moorland and limestone grasslands.
- A quiet rural area, with a strong sense of remoteness and long views out to the dramatic landforms of the surrounding upland landscapes.
- A pastoral landscape, with sheep and cattle grazing on the open moors, species-rich hay meadows and pastures and improved grasslands on lower-lying land within valleys and on the fringes.
- Fields bounded by drystone walls of local limestone which, along with field barns, form very strong patterns and reflect historical settlement and farming.
- Largely treeless on the higher land, with isolated windswept ash and rowan, with broadleaved woodlands in narrow gills and copses sheltering the isolated farmsteads and villages.
- Small mixed and coniferous woodlands and shelterbelts on lower land, especially to the north-west.
- Small historic villages, built with local limestone, often centred on long greens, with strong patterns of long tofts defined by walls, and isolated farmsteads.
- Several small rivers with high-quality water rising in the upland and flowing either to the north or south, many of which support internationally significant plant and animal communities.
- Long straight drove roads with wide verges, often very rich in flowering species.
- A rich legacy of visible archaeological evidence which, combined with a slow pace of development, gives the fells, the settlements and the wider landscape a visible time depth.
- Of considerable geological interest, with many extensive karst features and natural outcrops, along with evidence of past and current limestone extraction and quarrying.

Much of the farmland of the Orton Fells is characterised by its species-rich meadows and pastures, small streams, and field barns, walls and bridges all built of local limestone.

Orton Fells today

The Orton Fells are formed from a distinct block of limestone that runs north-west to south-east and rises to above 400 m at its highest point. The higher land is open and sweeping, with long-distance views out in all directions across valleys to the dramatic skylines of the surrounding uplands, and a strong sense of exposure and remoteness. Nine per cent of the NCA lies within the Lake District national Park. The upland is dissected by several streams and valleys, some forming dry valleys and some featuring rivers. The Leith, Lowther, Lyvennet, Hoff Beck and Scandal Beck rise here and flow north and west to join the River Eden. Other small rivers, such as Rais Beck, flow south to join the River Lune, which is important for its salmon and which flows from east to west through a shallow valley along the south of the area. Rivers tend to have low flows due to the underlying limestone, with some – for example Drybeck – exhibiting classic limestone dry stretches.

The limestone upland fells are characterised by extensive areas of limestone pavement, rock outcrops, scree and scars, as well as wide expanses of acid grassland, upland heath and mires, alongside contrasting herb-rich limestone grasslands. Much of it is common land, and sheep and cattle graze across this large-scale, largely treeless landscape, with just a few isolated windswept ash and rowan trees. High drystone walls define large enclosures. There are a small number of long straight roads crossing the upland, and few settlements, although there is plenty of evidence of early settlement, with stone circles, cairns, burial mounds, field systems and settlements.

Extensive areas of the fells, notably the Asby Complex, are designated as an SAC, for their range of karst features and their combinations of acid and base-rich soils that give rise to wet heath, with small areas of blanket bog, dry heath, and both acid and calcareous grassland. Outflows of calcareous water create alkaline fens and petrifying springs, which support rare species of snail and mosses. Some of the best examples of limestone pavement, with woodland species and assemblages of ferns growing within the sheltered grykes, can be found here. Great Asby Scar is a National Nature Reserve (NNR), where grazing is being excluded or reduced to encourage growth of scrub above the grykes. In contrast, Smardale NNR is a narrow wooded gill, with ash and wych elm woodlands alongside limestone grasslands. Smardale supports an outstanding range of northern butterfly species such as Scotch argus and northern brown argus. The area also supports populations of buzzards and ravens, along with breeding waders including lapwing, curlew, golden plover and red grouse.

An enclave of walled pastures with sheltering copses lies within the wider fells, close to a valley mire, with remnant upland ash woodland on the steep slopes of Asby Scar.

Because of the underlying limestone there are few waterbodies, making Sunbiggin Tarn, a marl lake, of particular interest with its rich fen and reed swamp flora and its tufa formations. The water quality of the streams and rivers is high and, as they flow over both limestone and bands of sandstone, the rivers comprise a range of habitat types, including shingles and gravels in the actively moving channels, which support diverse plant and animal populations. Several tributaries of the Eden are designated as an SAC, supporting rich plant communities along with brook and river lamprey, bullhead, salmon, white-clawed crayfish and otters.

On the lower-lying land within the valleys and along the fringes, fields are managed for livestock grazing (mainly sheep but some cattle). These fields provide hay, silage and winter grazing, and are bounded by drystone walls built of local limestone. In places these fields follow medieval open field systems of long narrow strips or small fields around settlements, giving rise to very strong historic field patterns. Some of the most species-rich hay meadows in Cumbria can be found here; they feature globeflower and lady's mantle. These meadows form part of the dispersed North Pennine Dales Meadows SAC. Wet grasslands provide nesting and feeding for species such as lapwing, curlew, redshank, snipe and yellow wagtail.

Woodland cover is sparse and is largely limited to copses of ash, with some sycamore, which shelter the isolated farmsteads, or clumps within the villages. Individual ash trees are found on the limestone pavements and along field boundaries. There are a few obtrusive conifer plantations on the higher land. Typical of the area are small upland ash woodlands, often found on the steep side slopes of the narrow valleys along the north side of the area, and often of ancient origin, as in Smardale and Crosby Gill.

With the underlying limestone there are few waterbodies. Here Sunbiggin Tarn, a rare marl lake, is seen in a view towards Crosby Garrett Fell.

The lower-lying undulating land in the north-west forms a transition between the upland limestone and the improved pastures of the Eden Valley, with fields of more intensively managed grasslands, and drystone walls giving way to hedges and fences. Here there are a number of small coniferous and mixed woodlands, established for timber, shelter and shooting interests.

The population is low, with dispersed and isolated farmsteads on the fells and fell sides, and several small and very quiet villages. These reflect a remarkably intact historical settlement pattern, along with evidence of earlier settlements. Villages are often clustered around a springline, on the lower hillsides and in the valleys; Orton and Newbiggin-on-Lune lie on the south side of the upland

ridge, with Lowther, Maulds Meaburn, Crosby Ravensworth, Great Asby and Crosby Garrett along the north side. The towns of Tebay and Kirkby Stephen lie on the south and east boundaries respectively. Several of the villages are of considerable historical interest, with largely intact houses, churches, village halls, farms and barns constructed from local limestone exhibiting a uniformity of scale, form and colour. Many still reveal medieval agricultural systems, with strip enclosures (tofts) to the rear of properties, patterns of open fields, and droveways leading out to common land. Some villages, such as Great Asby and Maulds Meaburn, are built around a long central green, with numerous small bridges crossing the stream.

Throughout the area there are many traditional farmsteads built of local limestone, with barns and outshots dispersed across the higher land, often sheltered by a copse of broadleaved trees. Local limestone has been used to build most of the farmsteads and villages, giving a high degree of visual unity to all the settlements. There is a limited network of quiet walled roads or outgangs, often long and straight with wide verges, which support a range of flowering species. This makes them a distinctive feature for visitors, as well as valuable for their biodiversity: they often act as repositories for meadow and calcareous grassland species.

The area is remarkably tranquil, with the distinctive calls of waders such as curlew and lapwing contributing to the sense of place and remoteness. Only the A6, the M6, the railway and the pylons, all contained within the main north–south transport corridor to the west, and the large quarries and works at Shap disturb the rural and remote feel of the landscape, although this impact is restrained by the landform, containing it within a narrow strip.

Most of the open fells are open access land, with some grouse shooting on Crosby Ravensworth Fell and Ash Fell. Visitors are attracted by the opportunities for quiet

Tarn Moor, seen here with a backdrop of the Howgills, comprises a mosaic of heather moorland along with acid and calcareous grassland.

recreation within a high-quality landscape, appreciating the geology and history, wildlife and angling. The network of quiet roads, including walled green lanes based on old drovers' tracks, provide good routes for walking, horse riding and cycling. The area is crossed by the Pennine Bridleway, the Coast to Coast Walk and the Walney to Wear cycle route, and also the historic Settle–Carlisle Railway in the east of the area.

Cultural connections include views painted from Orton Scar by J.M.W. Turner, and writings on the Coast to Coast Walk by A. Wainwright. Contemporary artist Andy Goldsworthy, working with local people, has created several distinctive 'sheepfold' structures on the fells.

The landscape through time

Continental collision and mountain building during the Devonian Period led to the emplacement of the Shap and Weardale Granites, which, with the older granites of the Lake District, underpin the upland areas of the Lake District to the west and the Alston Block to the east, creating the Stainmore Basin. The Orton Fells are dominated by Carboniferous rocks that were deposited in the Stainmore Basin. Deposits of sandstones such as the Ash Fell Sandstone, which forms a prominent bench in the west of the area, were followed by deposits of limestone, which now dominates. Repeated local rise and fall in sea levels resulted in marine limestone alternating with fluviodeltaic sediments – mudstones, siltstones and sandstones. These beds today create a sequence of parallel escarpments and extensive limestone pavements, most notably the Knipe Scar Limestone, which at Great Asby Scar forms the most extensive pavements outside Ingleborough. During the Pleistocene Period, ice flows from the Howgill Fells moved north-east across the limestone, scouring the landscape and exposing a pre-glacial karst landscape, influenced by the solution of limestone beneath a cover of acidic soil and vegetation. As water flowed down the dipping slope of the limestone, the characteristic grykes (channels) were formed in the direction of dip and the clints (blocks) parallel to the edge of the escarpment. Since the retreat of the ice, the continued weathering of the clints and grykes has given rise to a great variety of solution features on the pavement surfaces.

The retreat of the ice sheets deposited till over lower-lying areas. Other features of characteristic karst scenery include scars, outcrops and screes. An igneous granite intrusion containing highly distinctive large crystals occurs near Shap. It is surrounded by a broad aureole of metamorphosed rocks where it had contact with the limestone. To the north and east of Shap there are abundant

In this quiet rural area the small villages have undergone little development, and thus retain historic integrity and visual unity, as in Orton.

erratics of the distinctive pink Shap Granite which have been carried north and eastwards by the ice sheets. The development of tufa continues in calcareous outflows and springs and in the Sunbiggin Tarn marl lake.

Early farming and climatic changes led to clearance of forests and changes to soils. Evidence shows that settlements were established here as early as the Neolithic period, with a rich concentration of remains such as stone circles and burial mounds. Valleys were farmed during the Romano-British period, with remains of Roman roads still evident, but were then overlain by 6th- and

7th-century Anglian settlements, farmsteads and field patterns. Overall there is an exceptional assemblage of archaeological earthworks, including lynchets, ridge and furrow, field systems, enclosed and unenclosed farmsteads, dykes and tracks, all of which contribute to a landscape of nationally significant time depth.

The present settlement pattern was formalised during the 12th and 13th centuries, with nucleated and linear villages along springlines on the edges of the fells. Patterns of tenure and common rights were established which are still evident today, with strip enclosures to the rear of properties and droveways or outgangs providing links to common land. In places there are good examples of medieval open fields and settlement earthworks, as at Waitby and Smardale. Monastic granges such as Gaythorne and Asby developed from the 14th century, and the area was a centre of sheep rearing for quality fleeces. There are scattered remains of sheilings or summer settlements of monastic farms, some of which developed into farmsteads and hamlets, and of shrunken and deserted medieval settlements. There is also an exceptionally high survival of traditional farmsteads in the area, with farmsteads being rebuilt and adapted from the 17th century onwards. There is a high concentration of historic utilitarian features such as small disused quarries, lime kilns and sheepfolds, which reflects the underlying geology and land uses over the centuries. Enclosure of fields using drystone walls took place up to the mid-18th century, giving rise to the larger, more rectilinear field patterns.

The Settle–Carlisle Railway, built in the 1870s and now a Conservation Area, forms a distinctive linear feature crossing the area, with its classic railway architecture and heritage features. It carries both passenger and freight trains, and is an important alternative to the busy West Coast Main Line. Smardale viaduct, part of the disused Darlington–Tebay railway line, is a notable landmark and listed structure, along with Pendragon Castle and Lowther Castle.

The village of Crosby Garrett lies on the lower limestone slopes, surrounded by walled pastures and with a backdrop of the North Pennines and the Settle to Carlisle railway - both an active railway line and a Conservation Area - running in front.

There is visible evidence that, over time, limestone has been extracted from many small-scale quarries, largely for local use; but now just two large quarries remain, at Shap. One extracts Shap granite, and is an internationally significant site for its geological exposures, popular for undergraduate teaching and with amateur geologists.

Ecosystem services

Orton Fells 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 Orton Fells NCA is contained in the 'Analysis' section of this document.

Provisioning services (food, fibre and water supply)

- **Food provision:** The Orton Fells are an important area for rearing livestock, both sheep and cattle, with two-thirds of the farms focused on livestock grazing and 16 per cent on dairy farming. Nearly all the farmed land is grass and uncropped.

- **Water availability:** This is an area of relatively high rainfall, and several rivers rise from the limestone plateau and flow into the major water supply systems of the Lune and the Eden, which provide potable water to Carlisle and surrounds. Abstraction generally occurs downstream of this NCA, but within this area there are abstraction limits on the rivers Leith and Lune.

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

- **Climate regulation:** Some 13 per cent of the area is covered by peaty soils; semi-natural habitats cover approximately 12 per cent. These include upland heath, calcareous grassland and semi-natural woodland, all of which contribute to carbon capture and thus have a role to play in the mitigation of climate change impacts.

- **Regulating water quality:** Several of the tributaries of the Eden that rise from the limestone plateau in this area form a naturally base-rich river system with high water quality, and provide a diversity of ecological conditions that support a wide range of plant and animal communities. These tributaries are also within a catchment sensitive farming priority catchment, due to the risks to the condition of the water arising from diffuse pollution. The River Lune is also of good ecological quality and supports high-quality fishing.

- **Regulating water flow:** There is little flood risk within this NCA, but the area has a vital role to play in mitigating the severity of flood events downstream within settlements such as Carlisle and Lancaster. Land management measures to improve rates of water infiltration and to increase the holding capacity of the soils and vegetation in the upper reaches of the rivers are therefore particularly significant here in reducing downstream risk.

- **Regulating soil erosion:** Nearly one-third of the soils here can be vulnerable to poaching and compaction, while the peaty soils on the higher land are vulnerable to damage and subsequent wind and water erosion. Attention thus needs to be paid to land management practices, in particular the levels of grazing livestock. There is also scope for restricting access by livestock to river banks, to reduce trampling and erosion.

Cultural services (inspiration, education and wellbeing)

- **Sense of place/inspiration:** With its belt of limestone pavement and heath, species-rich grasslands, heritage features, and quiet roads and distinctive limestone villages, the area has a very strong sense of place, with some inspirational experiences on the open fells with their panoramic views out to adjacent uplands. J.M.W. Turner painted landscape views from Asby Scar, and Andy Goldsworthy has constructed a number of 'sheepfolds' that link history and geology to contemporary ideas.

- **Sense of history:** The lack of development or ploughing over time has resulted in the exceptional retention of visible evidence of early settlement, with stone circles, cairns, Roman roads and Romano-British settlements, along with evidence of medieval settlements and field patterns. The villages and farmsteads retain a high degree of historical integrity, with widespread use of local stone for building material, as well as many utilitarian structures such as lime kilns, field barns and sheepfolds, and the strong patterns of drystone walling.

- **Tranquillity:** With its low population, few settlements and widely dispersed farmsteads, the area is exceptionally tranquil, only disturbed by the largely contained main north–south transport corridor and quarries in the west.

- **Recreation:** The open access land and the network of quiet roads, with their flower-rich verges, bridleways and paths, provide plenty of opportunity for quiet recreation that is based on and supports the natural assets of the area, such as walking, riding, cycling, wildlife watching and botanising. There are opportunities for grouse and pheasant shooting, and the rivers provide high-quality angling.

- **Biodiversity:** The fells support a rich mix of limestone pavement, upland wet and dry heath, and calcareous and acid grassland, with an extensive SAC covering the Asby complex, which includes an NNR. Some of the best upland hay meadows in Cumbria can be found within the farmed land; along with some road verges these are designated as SAC. Smardale Gill, another NNR, comprises ash–wych elm woodland alongside calcareous grasslands, with outstanding populations of butterflies. Several of the rivers have also been afforded SAC designation for the diversity of freshwater habitats and species that they support.

The few roads that cross the area are often straight and quiet, with wide verges supporting a rich variety of flowers, some warranting designation as Sites of Special Scientific Interest.

- **Geodiversity:** Of particular note is the karst landscape with its limestone pavements, the most extensive in the UK. Linked to this are features such as disused quarries and lime kilns, which indicate the links between geology and past land uses. There is also a strong visual unity provided by the use of local stone for building farmsteads, villages and drystone walls, while the distinctive pink Shap granite is widely used in fine buildings nationally.

Statements of Environmental Opportunity

SEO 1: Conserve, manage and enhance the open fells on the limestone plateau, with their mix of karst features, upland heath, and calcareous and acid grasslands, for their inspirational and recreational values and their international biodiversity and geodiversity interest, improving water quality and mitigating climate change effects.

For example by:

- Maintaining the long, panoramic views in all directions, and the sense of remoteness and tranquillity on the open fells, by avoiding inappropriate development or planting of woodland.
- Ensuring that the limestone pavements, with their distinctive open character and rock formations and their geodiversity, biodiversity and historical interest, continue to be protected through Limestone Pavement Orders. Working with landowners to establish site-specific grazing regimes, including removing sheep in favour of cattle, to allow the vegetation to grow up above the grykes. Grazing management should help to retain the area's geological and historical interest and its open and expansive qualities.
- Protecting the range of other geological and geomorphological features such as natural outcrops, screes and shake holes and raising awareness, understanding and enjoyment of the geological interest of the area through providing information and interpretation in appropriate locations.
- Working with landowners, moorland managers, graziers and commoners to manage the grazing of blanket bog and wet and dry heath. Managing grazing by hardy cattle and sheep as appropriate, at levels and times that will encourage active peat formation where possible and good ecological condition of the heath plant communities, will protect the soils and enhance the diversity of the internationally significant plant communities.
- Ensuring that the areas of wet heath are under grazing regimes that will develop mixed heath plant communities that include a healthy component of bryophytes. This will aid the storage and infiltration of rainwater, thus reducing oxidation and erosion of the peat and colouration of the water, as well as protecting palaeo-environmental evidence.
- Protecting the springs and flushes at the headwaters of the river systems from damage by grazing livestock and from modification for livestock drinking water supply or drainage.
- Working with landowners, managers, graziers and commoners to seek opportunities to restore and expand the areas of species-rich calcareous grassland and manage them through appropriate grazing regimes.
- Supporting farmers in promoting high-quality meat from the local hardy breeds of cattle and sheep that graze the semi-natural habitats, thus linking the livestock production to the high environmental value of the area.
- Protecting the archaeological features of the fells, including bronze-age stone circles, burial mounds and Roman roads, and evidence of Romano-British settlements and boundaries, medieval settlements and field patterns. Provide interpretation where appropriate, to raise awareness and improve understanding of the links between geology and history.

SEO 2: Manage and enhance the enclosed farmland with its diverse pastures, leys and meadows, dispersed farmsteads and quiet villages, strong field patterns and drystone walls, and species-rich road verges, to maintain livestock and dairy farming, the soils, and the sense of place and history, and to enhance its landscape character and biodiversity value.

For example by:

- Encouraging extensive livestock grazing on pastures, limiting or eliminating applications of artificial fertilisers, and returning manure to the ground in preference, thus reducing poaching and allowing organic matter to build up, improving soil structure and quality as well as the infiltration of rainwater.
- Encouraging the management of pastures, especially those adjacent to heath and rough grazing, to create a range of hydrological conditions and to enhance their species richness, creating a patchwork of different grasslands that will provide suitable conditions for waders and other birds to nest, feed and roost.
- Finding ways of supporting the agricultural practice of hay-making to maintain and enhance the species-rich hay meadows, and bringing more fields into active management for hay to enhance their species richness and contribute to the patchwork of grassland types within the valleys.
- Ensuring that the biodiversity interest of road verges is monitored and recorded, and that their management continues to be adapted to protect and enhance their floristic interest, so that they function both as a repository of grassland species, linking other grassland sites, and as a source of nectar for pollinating insects, as well as being a delight to those using the roads.
- Maintaining and restoring the drystone walls, using local stone where possible and following local building styles, in particular restoring those areas of strong field patterns that retain evidence of medieval and post-medieval field systems.
- Managing and improving the condition of heritage assets and seeking to reduce inappropriate management, such as reducing or removing grazing from archaeological earthworks and ground features.
- Encouraging further survey and research to identify undiscovered archaeological earthworks and sub-surface archaeology, and working with local interest groups and other volunteers to record and manage them.
- Promoting the maintenance and restoration of traditional farm buildings and other buildings of historical interest using local materials, techniques and building styles.
- Supporting traditional building skills and maintaining the strong link between geology and built form in this area by using locally sourced materials and local skilled craftsmen for both walling and building repair and construction.
- Identifying and protecting those stretches of countryside with extensive evidence of settlement and field patterns that create distinctive historic landscapes, such as at Waitby and Smardale, and providing interpretation to improve understanding of past changes in the use and settlement of the land.

SEO 3: Manage farmed land and semi-natural habitats to protect and improve the condition of the streams and rivers, enhancing their ecological value and water quality, strengthening the contribution they make to the local landscape and providing high-quality angling and wildlife-watching opportunities.

For example by:

- On the fells, restoring any damaged or bare areas of peaty soil, managing the grazing levels to encourage good ecological condition, and avoiding any practices that damage or expose peat. This will prevent erosion by either wind or water and thus reduce colouration and sedimentation of the water.
- Within the lower-lying farmed land, encouraging the establishment of riparian habitats, such as permanent grassland with no fertilizer inputs, or scrub or open woodland of native species, to capture sediment, reduce nutrient run-off and impede flows of floodwaters.
- Within the lower-lying farmed land, finding opportunities to establish copses adjacent to watercourses, to provide shade for fish and other fauna. This is of particular importance should water temperatures rise, and to impede flows of floodwaters.
- On improved grasslands, encouraging low-input livestock systems and ensuring that the application of slurry and manure follows industry best practice, matching inputs to need and thus reducing nutrient run-off.
- Timing operations such as the cultivation and re-seeding of grasslands and avoiding the use of heavy machinery that might compact the soils, to protect soil structure and quality and to improve infiltration of rainwater.
- Promoting the improvement of roofed facilities for the storage of slurry and manure so that they are able to cope with more extreme weather conditions, keeping grey water in farmyards away from slurry stores, and avoiding spreading manure on wet or hard ground.
- Encouraging the establishment of riparian habitats, especially permanent unfertilised grassland, by fencing out livestock and providing watering points, thus avoiding trampling and erosion of the banks, reducing sedimentation of the water and capturing nutrients.
- Seeking opportunities to restore rivers to natural courses and allowing natural dynamic river processes, through removing hard engineering, redundant weirs and other structures where possible, thus increasing connectivity within the river and between the river and adjacent land.
- Ensuring that any further abstraction is carefully controlled to avoid impacting on the international biodiversity interest of the Lowther and other tributaries of the Eden, and on the limited resources of the Lune.
- Ensuring that the streams and rivers continue to support wildlife and fish, to offer high-quality birdwatching and angling.
- Encouraging access for the quiet enjoyment of the countryside and close contact with nature, so that more people can engage with and enjoy the wildlife, without detriment to the habitats, quality of the water or the plant and animal communities.
- Seeking opportunities to increase the area of flood storage within the lower stretches of the valleys, especially the Lune, and managing the areas to establish wet pastures or other wetland habitats.
- Providing information about the wetland features of petrifying springs and alkaline flushes on the fells and how the marl lake, Sunbiggin Tarn, came to be formed, with explanation of tufa formations, at locations that will not cause intrusion or damage to the habitats and species of the flushes and the tarn.

SEO 4: Identify, protect and interpret geological and historic features and encourage quiet recreation focused on enjoyment and appreciation of these features within the landscape.

For example by:

- Retaining the quiet rural nature of the villages through maintaining the historical and dispersed settlement pattern and ensuring that any new development is of a scale and location that fits within the village. Control the use of lighting, using timers and sensors, to maintain the dark night skies.
- Protecting the historical settlement pattern and character of the villages, with their central greens and tofts, and ensuring that conversions are carried out in a sympathetic way, using appropriate materials and styles and protecting the integrity of the historic buildings and features.
- Developing and implementing plans for the conservation of features of historical interest, especially within the village Conservation Areas and the Settle–Carlisle Railway Conservation Area, providing information and interpretation about the past uses of the buildings and their connections with the wider landscape.
- Protecting and maintaining the many utilitarian features such as lime kilns and sheepfolds which reflect past settlement and farming practices, providing interpretation where appropriate to improve understanding and enjoyment of the role of these heritage assets.
- Supporting the restoration of rivers to more natural routes, thus enabling the creation of a wider range of geomorphological features, such as meanders, and also enhancing biodiversity value and reducing the energy of flood flows.
- Utilising the disused and active quarries with their exposures of underlying rocks, working with quarry companies and landowners to provide access and interpretation where appropriate, to gain improved understanding and appreciation of geology.
- Providing interpretation of the uses of local stone, especially as building stone for farmsteads and the houses and communal buildings in local villages.
- Encouraging the restoration of drystone walls, using appropriate styles and techniques according to their historical origin.
- Encouraging quiet recreational activities that support and benefit from the high-quality rural environment and that make use of the open access areas and networks of quiet roads, tracks, bridleways and footpaths, such as walking, cycling, riding, wildlife watching, botanising, visiting heritage assets, exploring geological features, and angling, providing for all abilities where possible.
- Where appropriate, providing access to and interpretation of sites of wildlife, geological and historical interest, to enable educational use. Encourage people of all levels of ability and interest to be able to appreciate and be inspired by the landscapes of the area.
- Working with local geologists and others to encourage research, identify further local sites of interest and provide interpretation of the local geology, especially the karst features, to raise awareness and appreciation.

Continued over...

SEO4 continued:

For example by:

- Keeping those areas of limestone pavement with particular geomorphological and historical interest clear of scrub or woodland, to enable research and appreciation of the features.
- Encouraging engagement by both residents and visitors in activities that will protect and enhance the many historical, geological and wildlife features in the landscape, thus improving understanding and enjoyment of the natural environment.
- Working with local landowners and managers to provide facilities such as accommodation and refreshments for users of long-distance routes and to include discreet and imaginative interpretation of the key features and assets of the area.
- Working with local tourism organisations and accommodation providers to establish local routes from villages to key features, for improved recreation and enjoyment, providing clear and engaging information to all visitors, thus enabling them to learn about and enjoy the distinctive landscape.

Most of the villages retain a structure laid down in medieval times, as here in Maulds Meaburn where the houses and farms are set back and the River Lyvennet flows through the middle of the central green.

Additional opportunity

1. Manage and enhance the fragmented semi-natural woodlands and copses, expanding and buffering them, and improve the condition of the conifer shelterbelts, to increase carbon capture, improve rainwater infiltration, develop their biodiversity interest and improve their contribution to local landscape character.

For example by:

- Protecting and managing semi-natural ancient woodlands, restoring those that have been planted up with non-native species, and extending and buffering them, using natural regeneration of native broadleaved species of local provenance where possible, to increase their resilience to climate change as well as pests and diseases.
- Bringing semi-natural woodland into management, leaving patches of deadwood, incorporating open glades and encouraging natural regeneration, especially of native broadleaves, thus increasing the provision of wood fuel for local use, increasing carbon capture, enhancing biodiversity interest and ensuring the long-term contribution of the woodlands to the landscape.
- Ensuring in particular that upland ash woodlands are under sound management, with good natural regeneration of ash and other native species, to increase their resilience to climate change and ash die-back.
- Seeking opportunities to buffer, expand and link fragmented semi-natural woodlands by creating new woodlands, especially within the narrow valleys along the lower stretches of the rivers, and in riparian zones where they can impede flood flows and improve infiltration, but avoiding impacting on species-rich grasslands or historic features.
- Seeking opportunities to establish small copses of native broadleaves within gills on the margins of the fells, while retaining their open character.
- Seeking opportunities to restore upland areas to heath and/or grassland from conifer plantations, with compensation planting sites in more appropriate locations.
- Encouraging the management of conifer plantations and small coniferous shelterbelts, including opening up small glades and increasing the broadleaf component to encourage the development of a richer ground flora, and improving their form to assimilate them more effectively into the landscape, as well as enhancing their biodiversity interest, improving the underlying soils and increasing the production of timber and wood fuel.
- Encouraging the management of the copses related to farmsteads and villages, to ensure regeneration of native tree species and thus the long-term continuity of the landscape feature.
- Encouraging landowners and interest groups to survey and monitor the incidence of the ash die-back disease, identify any naturally resistant strains and take appropriate biosecurity measures.

Supporting document 1: Key facts and data

Total area: 29,280 ha

1. Landscape and nature conservation designations

The Orton Fells lie to the east of the Lake District National Park, with 2,534 ha (9 per cent of the NCA) falling within the National Park. It lays immediately south-west of the North Pennines Area of Outstanding Natural Beauty (AONB).

A management plan for the protected landscape can be found at: http://www.lakedistrict.gov.uk/

Source: Natural England (2011)

Please note: Part of this NCA is affected by an Order extending the Yorkshire Dales 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)	% of NCA
International	n/a	n/a	0	0
European	Special Protection Area (SPA)	n/a	0	0
	Special Area of Conservation (SAC)	Asby Complex SAC, River Eden tributaries SAC; North Pennine Dales Meadows SAC	3,129	11
National	National Nature Reserve (NNR)	Great Asby Scar NNR, Smardale Gill NNR	347	1
National	Site of Special Scientific Interest (SSSI)	A total of 19 sites wholly or partly within the NCA	3,868	13

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.

The total area designated is 3,868 ha. The Special Areas of Conservation overlap with SSSI designation. Several of the upper stretches of tributaries of the River Eden, which are designated SSSI, fall within this NCA, although the main river falls within the Eden Valley NCA.

There are 46 local sites in the Orton Fells covering 589 ha which is 2 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/website/magic/ – select 'Rural Designations Statutory'.

1.1.1 Condition of designated sites

SSSI condition category	Area (ha)	% of SSSI land in category condition
Unfavourable declining	156	4
Favourable	485	13
Unfavourable no change	171	5
Unfavourable recovering	3,033	79

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 Orton Fells are a distinct upland block of limestone, lying mostly between 150 m and 300 m altitude with moorlands at Great Asby Scar reaching over 400 m.

Source: Natural England (2010)

2.2 Landform and process

The central block of Carboniferous Limestone stretches from Crosby Ravensworth Fell in the west to Ash Fell in the east. The limestone beds dip gently to the north-east, creating a series of parallel escarpments, and drop down to the Eden Valley in the north-east, and the Lune valley in the south. The southern part of the area is dominated by karst landscape with extensive limestone pavements such as Great Asby Scar.

Source: Orton Fells Countryside Character Area description

2.3 Bedrock geology

The predominant underlying rock in the Orton Fells is Carboniferous Limestone, which has formed a low ridge of hills that show the influence of glacial action and subsequent weathering. They are characterised by extensive areas of outcropping limestone, scars, limestone pavements and other karst features. The extensive exposures of Carboniferous rocks (including the stream sections that run off the NCA) are also important for understanding Carboniferous environments at a national and international level. The limestone exposed at Little Asby Scar is the global reference sequence for the Asbian Stage of rocks of this age, and exposures reveal characteristic fossils and features of this limestone. Also present are beds of sandstone and shale, as part of the Yoredale Series.

Source: Orton Fells Countryside Character Area description

2.4 Superficial deposits

The last glaciations as well as scouring the landscape and revealing the underlying limestone also deposited till as the ice sheets retreated. These deposits gave rise to acidic soils, although much of the higher land was devoid of till so that the limestone geology had more influence. Erratic boulders of Shap granite are found in the north of the area as well as reworked erratics from the Southern Uplands which provide evidence of earlier glaciations. Springs and outflows of calcareous water create local tufa deposits, while deposits of less permeable marl have given rise to water features, notably Sunbiggin Tarn.

Source: Orton Fells Countryside Character Area description

2.5 Designated geological sites

Designation	Number of sites
Geological Site of Special Scientific Interest (SSSI)	5
Mixed interest SSSI	3

There are 7 Local Geological Sites within 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

2.6 Soils and Agricultural Land Classification

This NCA has 7 main soilscape types: freely draining slightly acid but base-rich soils, covering 38 per cent of the NCA; slowly permeable seasonally wet acid loamy and clayey soils (27 per cent); freely draining slightly acid loamy soils (16 per cent); very acid loamy upland soils with a wet peaty surface (8 per cent); slowly permeable wet very acid upland soils with a peaty surface (5 per cent); slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (4 per cent); and Loamy and clayey flood plain soils with naturally high groundwater (2 per cent). Soils on the higher limestone block are generally thin and infertile, while acidic soils that have developed from overlying drift contrast with the calcareous soils. Generally soil carbon levels are low (0 to 5 per cent); higher soil carbon levels are associated with peaty soils where areas of upland heath have developed.

Source: National Soil Resources Institute Soilscapes Maps, Natural England (2010), Orton Fells Countryside Character Area description,

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)	% of NCA
Grade 1	0	0
Grade 2	0	0
Grade 3	5,264	18
Grade 4	14,659	50
Grade 5	9,357	32
Non-agricultural	0	0
Urban	0	0

Source: Natural England (2010)

Grade 5 soils occur on the upland limestones, with Grade 4 on the side slopes to the north and south. The more productive soils, Grade 3, are found along the northern boundary, on the slopes that drop down to the Eden Valley in the north.

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

3. Key water bodies and catchments

3.1 Major rivers/canals

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

Name	Length (km)
River Lune	12
River Lowther	7
River Eden	7
River Lyvennet	3
Birk Beck	1

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.

The River Lune flows west along the southern boundary of the NCA, before turning to flow south between the Howgill Fells and the Cumbria Fells. The River Eden cuts through the eastern end of the NCA, flowing north before turning to flow north-west through the Eden Valley. A large number of small tributaries, including the Lyvennet, rise in the upland block and flow north to join the River Eden, which eventually joins the Solway Firth. The Lowther flows north across the western end of the NCA, to join the Eden at Penrith.

3.2 Water quality

The total area of Nitrate Vulnerable Zone is 3,757 ha, or 13 per cent of 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 1,398 ha of woodland over 2 ha (5 per cent of the total area), of which 1 per cent is ancient woodland.

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

4.2 Distribution and size of woodland and trees in the landscape

The upland block is largely treeless with only very occasional windswept ash trees. Elsewhere there is limited woodland with sheltering copses around farmsteads, and copses and small woodlands of broadleaves, conifers and mixed species associated with the villages and farmsteads. There are some conifer plantations, notably around Reagill, in the valley of the River Lowther and between here and the M6, and these include some replanted ancient woodland sites. The valleys of Smardale Gill and Crosby Gill are notably more wooded, with ancient semi-natural woodlands clothing the gill sides. Ash trees are the most prominent species of tree in the landscape and are found as isolated specimens on the limestone pavements or scattered individual trees associated with the fields on lower land. Farmsteads are often sheltered by small copses of sycamores or mixed plantations.

Source: Orton Fells Countryside Character Area description, Countryside Quality Counts 2003

4.3 Woodland types

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

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

Woodland type	Area (ha)	% of NCA
Broadleaved	500	2
Coniferous	639	2
Mixed	97	<1
Other	162	1

Source: Forestry Commission (2011)

Area and proportion of Ancient Woodland and Planted Ancient Woodland within the NCA.

Woodland type	Area (ha)	% of NCA
Ancient semi-natural woodland	116	<1
Ancient re-planted woodland (PAWS)	270	<1

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

Local limestone is commonly used for drystone wall field boundaries, with some hedgerows and fences in the valleys. Over 688 km of drystone walls and stone faced hedgebanks are currently under management, and a further 108 km of hedgerows, through the Environmental Stewardship scheme.

Source: Orton Fells Countryside Character Area description; Countryside Quality Counts (2003)

5.2 Field patterns

While the upland stretches of limestone are largely unenclosed, elsewhere the

area has strong field patterns, formed mostly by drystone walls, with some hedgerows and fences in lower land.

Source: 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

In 2009 the majority of holdings (67 per cent) were based on grazing livestock, with 16 per cent dairy farming and 12 per cent 'other', likely to be predominantly horse rearing. Between 2000 and 2009 there was a slight reduction in the number of dairy farms.

Source: Agricultural Census, Defra (2010)

6.2 Farm size

While 47 per cent of holdings are below 50 ha in size these only account for 8 per cent of the farmed land area. One third of the holdings are large (over 100 ha) and account for 79 per cent of the area, and the number of these large holdings doubled between 2000 and 2009 (going from 47 to 94 holdings). These figures do not take into account the rights that many farms have to common grazing on the moors.

Source: Agricultural Census, Defra (2010)

6.3 Farm ownership

2009: Total farm area = 29,860 ha; owned land = 18,557 ha
2000: Total farm area = 14,648 ha; owned land = 6,642 ha

Source: Agricultural Census, Defra (2010);

6.4 Land use

In 2009 the vast majority of the land was grass and uncropped (96 per cent) and this had reduced only slightly from 98 per cent in 2000. The area devoted to cereals went from 1 per cent in 2000 to 3 per cent (899 ha) in 2009.

Source: Agricultural Census, Defra (2010)

6.5 Livestock numbers

The predominance of livestock rearing is made clear by the figures; in 2009 there were 171,700 sheep (up from 149,300 in 2000) and 22,200 cattle (up from 14,400 in 2000).

Source: Agricultural Census, Defra (2010)

6.6 Farm labour

In 2009 the majority of holdings (476) were run by principal farmers, and this had increased from 307 in 2000. There were 53 full time and 44 part time workers, with little change since 2000, although the numbers of part time and casual / gang workers had both increased since 2000.

Source: Agricultural Census, Defra (2010)

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

7. Key habitats and species

7.1 Habitat distribution/coverage

The area is characterised by outcropping limestone along the main ridge, often forming extensive bare limestone pavements with their particular communities of woodland and rare species protected within the grykes. Elsewhere thin soils over the limestone support species-rich calcareous grassland. However, in places drift deposits give rise to more acidic soils where upland heath and acidic grassland occur, often forming mosaics with calcareous grasslands and limestone pavement.

Lime-rich springs and flushes are abundant and support rare plant and invertebrate communities. The marl lake Sunbiggin Tarn is a well known feature of the area, supporting important aquatic and fen communities.

There are also unimproved pastures in the higher limestone farmed areas, and some species-rich meadows remain among the more intensively farmed areas on the lower lying land. But it is the often wide road verges that now act as one of the main resources of species-rich grassland in the area.

Semi-natural broadleaved woodland is restricted to the steep side slopes of the deeper valleys.

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)	% of NCA
Upland heathland	1,878	6
Upland calcareous grassland	815	3
Broadleaved mixed and yew woodland (broad habitat)	288	1
Limestone pavement	283	1
Lowland calcareous grassland	106	<1
Purple moor-grass and rush pastures	66	<1
Lowland meadows	54	<1
Upland hay meadows	45	<1
Blanket bog	34	<1
Coastal and flood plain grazing marsh	1	<1

Source: Natural England (2011)

- Maps showing locations of Priority Habitats are available at: http://magic.defra.gov.uk/website/magic/ – select 'Habitat Inventories'

7.3 Key species and assemblages of species

- Maps showing locations of Priority Habitats are available at: http://magic.defra.gov.uk/website/magic/ – select 'Habitat Inventories'
- Maps showing locations of S41 species are available at: http://data.nbn.org.uk/

8. Settlement and development patterns

8.1 Settlement pattern

The population of the area is low and limited to villages on lower land along the north-east side and along the south and west sides. Most of the settlements are located close to natural springs and many of them retain historic features. Some have striking linear layouts with strip enclosures, with a back land separating the crofts from the tofts. Isolated farmsteads from 18th and 19th century are widely dispersed.

Source: Orton Fells Countryside Character Area description; Countryside Quality Counts (2003)

8.2 Main settlements

Kirkby Stephen on the eastern edge of the area is the only large town. Other settlements include Ravenstonedale, Newbiggin on Lune and Gaisgill along the

Lune on the south side, Askham and Lowther to the west, and Sleagill, Maulds Meaburn, Crosby Ravensworth and Crosby Garrett along the north-east side. Orton and Shap are the only two settlements on or close to the limestone ridge. The total estimated population for this NCA (derived from ONS 2001 census data) is: 5,861.

Source: Orton Fells Countryside Character Area description; Countryside Quality Counts (2003)

8.3 Local vernacular and building materials

Most of the villages are distinctive through the widespread use of local limestone for buildings and walls.

Source: Orton Fells Countryside Character Area description; Countryside Quality Counts (2003)

9. Key historic sites and features

9.1 Origin of historic features

There is considerable prehistoric activity visible in the form of stone circles and burial mounds suggesting extensive clearance, farming and settlement across the Fells in the Neolithic and Bronze Age periods. Nuclear and linear villages located on spring lines show patterns of tenure and common rights based on long-established sheep rearing activity. In the medieval period the area was a centre of sheep rearing for quality fleeces, based largely around large monastic houses, such as the Premonstratensian Abbey at Shap. Field enclosures around the villages were mostly carried out between the 14th and 18th centuries, while the enclosure of the larger, more rectilinear fields further afield were largely completed by the mid 18th century.

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

9.2 Designated historic assets

This NCA has the following historic designations:

- 3 Registered Parks and Gardens covering 552 ha
- 0 Registered Battlefields
- 130 Scheduled Monuments
- 324 Listed Buildings

Source: Natural England (2010)

More information is available at the following address:

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

10. Recreation and access

10.1 Public access

- Twenty-seven per cent of the NCA 7,772 ha is classified as being publically accessible.
- There are 414 km of public rights of way at a density of per 1.4 km/ km2.
- There is 1 National Trail (Pennine Bridleway) within the Orton Fells. 22 km of this runs from Bowerdale in the Lune Valley across Ash Fell to Soulby.
- The internationally known Coast to Coast Walk from St Bee's Head in Cumbria to Robin Hood's Bay in North Yorkshire crosses the NCA.

Sources: Natural England (2010)

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

Access designation	Area (ha)	% of NCA
National Trust (Accessible all year)	0	0
Common Land	5,297	18
Country Parks	0	0
CROW Access Land (Section 4 and 16)	7,194	25
CROW Section 15	37	<1
Village Greens	63	<1

Access designation	Area (ha)	% of NCA
Doorstep Greens	0	0
Forestry Commission Walkers Welcome Grants	0	0
Local Nature Reserves (LNR)	0	0
Millennium Greens	0	0
Accessible National Nature Reserves (NNR)	351	1
Agri-environment Scheme Access	16	<1
Woods for People	101	<1

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) the area is very tranquil, with lower levels of tranquillity confined to the M6 / A6 corridor, with its railway line and quarries, that runs north–south through the western part of the NCA, the A685 that runs close to the southern boundary, and the surrounds of Kirkby Stephen.

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

Tranquillity	Tranquillity Score
Highest value within NCA	49
Lowest value within NCA	-28
Mean value within NCA	9

Sources: CPRE (2006)

More information is available at the following address:
http://www.cpre.org.uk/what-we-do/countryside/tranquil-places/in-depth/item/1688-how-we-mapped-tranquillity

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 the area is largely undisturbed, with the exception of the M6 / railway corridor and the major limestone quarries. A breakdown of intrusion values for this NCA is detailed in the table below.

Intrusion category	1960s (%)	1990s (%)	2007 (%)	Percentage change (1960s-2007)
Disturbed	4	27	26	22
Undisturbed	96	73	74	-22
Urban	0	0	0	0

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are the impact of the transport corridor; this has increased considerably since the 1960s.

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

- Woodland cover, at 4 per cent of the area, is limited to steep sides of valleys, sheltering clumps around farmsteads and in villages, and small coniferous and mixed plantations especially in the north-west. Countryside Quality Counts for the period 1999–2003 indicated that there was a significant uptake of woodland grants for restocking and management of establish woodland, although by the end of the period only around a third were covered by woodland grant schemes.

- New woodlands of native broadleaved species have been established at Gaythorne, and community woodland at Hackthorpe and Orton.

Boundary features

- The length of boundaries is estimated to be 1,248 km. The introduction of the Environmental Stewardship Scheme in 2005 brought over 688 km of drystone walls and stone faced hedgebanks, 108 km of hedgerows and 9 km of ditches under management by 2010.

- In recent years temporary fencing has been erected, for instance on Crosby Ravensworth Common and Gaythorne Plain, to assist with recovery of limestone pavement flora and the establishment of new woodland.

- There has been some loss of boundary features in recent years owing to both removal and lack of management. This has affected both walls, for example, around Orton, and hedges in the fringing farmland, for example, around Sleagill and Reagill.

Agriculture

- The 2001 foot and mouth disease outbreak affected this area considerably although sheep numbers have now recovered. In 2000 there were 149,300 sheep, and in 2009 this had increased to 171,700. Cattle numbers also increased, from 14,400 in 2000 to 22,200 in 2009. The predominant agricultural activity remains livestock rearing (67 per cent of holdings), with some dairy holdings (16 per cent).

- In 2009 farms over 100 ha accounted for 79 per cent of the farmed area, up from 69 per cent in 2000.

- The most extensive Countryside Stewardship agreements in 2003 were for enhancing heather moorland and upland in-bye pasture.

- Changes in agricultural practices since the 1950s, notably from hay-making to silage and haylage, along with increases in fertiliser applications and re-seeding, have resulted in a decline in species-rich hay meadows, while changes in grazing have affected the species diversity of the calcareous grasslands.

Settlement and development

- There is little development pressure, with housing contained within villages or farmsteads. Recent industrial and commercial development has been limited to the transport corridor along the west, with electrification of the main railway line, pylons, and the M6.

Semi-natural habitat

- The main semi-natural habitats occur along the elevated land, and comprise upland heath, calcareous grassland and limestone pavement; these areas have remained relatively consistent, although their condition has improved. Sites of Special Scientific Interest cover 13 per cent of the area, of which 91.5 per cent are now in favourable or favourable recovering condition. This recent improvement is largely due to the introduction of more sustainable grazing regimes through agri-environment schemes.

Historic features

- In 1918 it was estimated that some 5 per cent of the area was historic parkland, but by 1995 it was estimated that nearly two thirds of this had been lost. About half of the remaining parkland is now benefiting from management under agri-environment schemes. Only a very small proportion of farm buildings (6 per cent) have been converted to non-agricultural uses, although there is an above average percentage (13 per cent) showing signs of structural disrepair.[4]

Coast and rivers

- Overall the ecological quality of the watercourses in 1995 was predominantly very good and has remained good, although the quality of the River Lowther is only moderate. The chemical water quality of the rivers was also predominantly very good, and has been maintained, but the groundwater under the Lune catchment is now poor, probably due to diffuse pollution. This northern part of the NCA is a target area for action under the Catchment Sensitive Farming Delivery Initiative.

- The quality of Sunbiggin Tarn, a marl lake, is declining due to an increase in sediment and silt, and the reasons behind this are being researched. This may include the presence of a large black-headed gull colony until a few years ago.

[4]Photo Image Project, English Heritage (2006)

Minerals

- In recent decades there has been extensive limestone quarrying and stone extraction from limestone pavements, largely for rockery use. Since the 1980s, limestone pavements have been protected by Limestone Pavement Orders which prevent further damage to these unique geological features. There are two large active quarries at Shap – Shap Beck Quarry produces limestone, while Shap Fell produces Shap 'Blue' granite, used for hardcore and aggregate for road making, and the more famous Shap 'pink' granite, a decorative stone widely used for building frontages. Nearby the Hardendale Quarry extracts limestone.

The extensive stretches of open limestone pavement on the plateau, as at Great Asby Scar NNR, reveal rock formations of geological interest, while specialised plants grow within the grykes.

Drivers of change

Climate change

- Evidence from UK Climate Impacts Programme[5] shows that over the coming century the climate of the Lake District and surrounds is expected on average, to become warmer and wetter in winter and hotter and drier in summer. Under 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 in frequency and intensity of extreme events (floods/droughts).

- The Orton Fells have been assessed as having a moderate vulnerability to climate change.[6] The area's limestone uplands are likely to have a low vulnerability, whereas the farmlands to the north-east of the limestone plateau have medium to low vulnerability. There is reasonable topographical variation throughout the NCA which gives it some resilience to climate change.

- The limestone uplands are already relatively well adapted to dry environments due to their existing karst conditions and the plant communities which include drought resistant plant species. Thus any reduction in precipitation is likely to have less impact, although some south-facing slopes may well experience extreme drought conditions.

- In the lower-lying farmland, changes to seasonal rain patterns are likely to lead to grass growth earlier in the year, but summer drought on the shallower soils may restrict biomass production. Plant communities within the upland hay meadows may change slowly to resemble plant communities of lowland hay meadows.

- Semi-natural habitats will need to be buffered, extended and linked to make them more resilient to climate change impacts, while links and connecting habitats will be needed to enable species movement through the landscape in response to climate change.

- There may be more extreme and more frequent storm events which would exacerbate scour and erosion of the upland stream courses, and lead to an increase in sediment load in the watercourses, thus reducing water quality.

Other key drivers

- There is likely to be an increasing demand for national food security, which could result in more intensive management of grasslands leading to a loss of species-rich meadows and pastures, and of archaeological earthworks.

- There is a perceived process of consolidating small dairy farms into fewer large farms which may continue.

- Farming may become less attractive to future generations due to increasing capital costs of land and infrastructure, and the unpredictable nature of climate change impacts.

- Continued lack of maintenance of drystone walls could lead to deterioration and possible loss.

[5] http://ukclimateprojections.defra.gov.uk/21708 (accessed March 2013)

[6] *An Assessment of the Vulnerability of the Natural Environment to Climate Change in North West England Using the National Character Areas*, Natural England (2010)

- Lack of management of woodlands, especially upland ash woodlands, could lead to their decline, which may be exacerbated by ash die-back disease.
- Existing farms may continue to move into diverse activities, including providing for tourism.
- The review of the EU funded Rural Development Programme for England to take effect from 2014 may offer new opportunities for funding environmentally sensitive farming practices
- Measures taken to meet the requirements of the Water Framework Directive will include the introduction of mains sewerage to the more remote villages and farmsteads.
- Groups like the Eden Rivers Trust are likely to continue carrying out measures to improve water quality to meet Water Framework Directive requirements, such as fencing livestock away from watercourses and carrying out tree planting.
- Development pressure is likely to remain low, but with continuing demand for affordable housing to meet the needs of local communities, and conversions of farm buildings to housing, some for second home use and some as holiday cottages.
- The need to meet growing energy demands by using renewable sources will result in continuing pressure for wind turbines in and around the area, although there is less potential for providing hydro-power or biomass.
- There is likely to be continuing demand for limestone and Shap granite, with pressure for extending depth of working and the working life at existing quarries.
- There have been recent increases in the numbers of people visiting the area for outdoor recreation, notably walking, cycling and horse riding, and visitor numbers are likely to increase with a raised awareness of the history, geology and wildlife interest of the area.

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.

There are impressive views out in all directions from the plateau of Orton Fells to the adjacent uplands. This view, from a stretch of limestone pavement on Muddygill Plain, is looking north-east over the walled pastures and farmsteads of the lower lying land in the Orton Fells. Beyond is the fertile Eden Valley, with the backdrop of the dramatic scarp of the North Pennines.

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: Conserve, manage and enhance the open fells on the limestone plateau, with their mix of karst features, upland heath, and calcareous and acid grasslands, for their inspirational and recreational values and their international biodiversity and geodiversity interest, improving water quality and mitigating climate change effects.	↗ **	↔ ***	↗ **	N/A	↔ ***	↗ **	↑ ***	↗ **	↗ **	↗ **	↗ *	↗ *	N/A	↑ ***	↑ **	↗ ***	↗ **	↑ ***	↗ ***
SEO 2: Manage and enhance the enclosed farmland with its diverse pastures, leys and meadows, dispersed farmsteads and quiet villages, strong field patterns and drystone walls, and species-rich road verges, to maintain livestock and dairy farming, the soils, and the sense of place and history, and to enhance its landscape character and biodiversity value.	↑ **	↔ ***	↗ **	N/A	↔ ***	↗ **	↑ ***	↗ **	↑ **	↗ **	↗ **	↗ *	N/A	↑ ***	↗ **	↔ **	↔ **	↑ ***	↔ **
SEO 3: Manage farmed land and semi-natural habitats to protect and improve the condition of the streams and rivers, enhancing their ecological value and water quality, strengthening the contribution they make to the local landscape and providing high-quality angling and wildlife-watching opportunities.	↗ **	↔ ***	↗ ***	N/A	↔ ***	↗ **	↑ ***	↑ **	↗ **	↑ ***	↗ **	↔ *	N/A	↗ **	↔ **	↗ *	↑ **	↑ ***	↔ **
SEO 4: Identify, protect and interpret geological and historic features and encourage quiet recreation focused on enjoyment and appreciation of these features within the landscape.	↔ **	↔ ***	↔ **	N/A	↔ ***	↔ **	↔ **	↔ **	↔ **	↔ **	↔ **	↔ *	N/A	↑ ***	↑ ***	↗ **	↑ ***	↗ ***	↑ ***

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
Wide plateau of open sweeping limestone upland with heath and grasslands, grazed by sheep and cattle, largely treeless, with a strong sense of remoteness and tranquillity, enhanced by long-distance views to dramatic skyline of surrounding uplands.	■ 24 per cent of the area is common land, with rights for sheep and cattle grazing. ■ Some moors managed for grouse shooting. ■ Surrounded by Howgills to the south, Yorkshire Dales to the south-east, North Pennines to the east and north, and the Lake District to the west. ■ Long and panoramic views in all directions contribute to sense of place and remoteness.
Pastoral landscape with pastures and meadows, many of them rich in flowering species, bounded by drystone walls and with field barns in the valleys and on lower-lying land on the fringes.	■ A long history of livestock rearing, managing the land to produce grass, silage and hay. ■ 18 per cent of the land is Grade 3, 50 per cent is Grade 4, and 32 per cent is Grade 5. ■ 96 per cent of the land is grass/uncropped. ■ The area carries over 170,000 sheep and over 22,000 cattle (mostly beef, with dairy farms comprising 16 per cent of holdings). ■ Nearly 700 km of drystone walling is under management through the Environmental Stewardship Scheme. ■ Some of the best upland hay meadows are found here, and are designated as Special Areas of Conservation or Sites of Special Scientific Interest.
Limited woodland cover, with broadleaved copses sheltering isolated farmsteads and upland ash woodlands on steep valley sides; some conifer plantations and mixed shelterbelts.	■ Only 4.8 per cent woodland cover, with just 500 ha broadleaved woodland. ■ 116 ha of ancient semi-natural woodland, and 270 ha of ancient re-planted woodland. ■ Several small conifer plantations and mixed shelterbelts in the north-west of the area, often unsympathetically shaped and needing management.
Sparse population gives rise to quiet rural feel with historical villages, built with local limestone, and overall high levels of tranquillity.	■ CPRE map (2006) shows high tranquillity levels. ■ 74 per cent of the area is undisturbed, with some disturbance noted along the transport corridor to the west, the A685 in the south, and around the town of Kirkby Stephen. ■ Low population, estimated at around 5,800. ■ 324 listed buildings. ■ Distinctive villages retaining limestone vernacular architecture.

Landscape attribute	Justification for selection
Several small rivers flowing through narrow valleys, many of international significance for their plant and animal communities.	■ Leith, Lowther, Lyvennet, Hoff Beck, Potts Beck and Scandal Beck are all tributaries of the River Eden, and are designated Special Areas of Conservation for much of their lengths. ■ The upper stretches of the River Lune are important for salmon fishing. ■ Smardale Gill is lined with broadleaved woodland on the steep side slopes and is a National Nature Reserve for its grasslands, woodlands and butterfly populations.
Long straight drove roads with wide verges, often very rich in flowering species.	■ Some verges merit inclusion within a Site of Special Scientific Interest, such as Raisebeck Meadows.
Many karst features such as limestone pavement, outcrops and screes.	■ Extensive limestone pavements, many now covered by Limestone Pavement Orders to prevent further damage. ■ Widespread evidence of small-scale quarrying to meet local needs. Now just a few large active quarries extracting Shap granite and limestone at Shap and Hardendale.
Rich time depth with historical evidence visible in the many stone circles, medieval field patterns, traditional farmsteads and springline villages.	■ 130 scheduled monuments, including stone circles, cairns, Roman roads, Romano-British and medieval settlements and field systems, dykes, deer parks, farmhouses and Smardale railway viaduct. ■ Villages still revealing medieval agricultural systems with long strip enclosures, central greens and droveways to common land.
The geological, historical and biodiversity value of the area, combined with open access land and a network of trails, paths and quiet roads, provide a high-quality landscape setting for outdoor pursuits including walking, cycling, horse riding, wildlife watching and fishing.	■ Nationally significant recreation routes including the Pennine Bridleway, Coast to Coast Path and two national cycle routes pass through the area. ■ 27 per cent of the area is publically accessible, much of this being the open access land on the fells. ■ 347 ha of accessible National Nature Reserves.

Landscape opportunities

- Maintain grazing of wet and dry heath and grasslands by both cattle and sheep, at levels that will encourage good ecological condition and maintain and enhance the diversity of plant communities.
- Support the protection of limestone pavements through enforcing Limestone Pavement Orders.
- Maintain open upland landscape with long, uninterrupted and panoramic views.
- Seek ways of reducing obtrusiveness of the few conifer plantations on the higher land.
- Seek ways of supporting the agricultural practice of hay-making to maintain and enhance the species-rich hay meadows; bring more fields into management for hay, to enhance their species richness and contribute to the patchwork of grassland types within the valleys.
- Encourage the promotion of local brand meat, based on hardy beef cattle that are used to graze semi-natural habitats.
- Maintain and restore drystone walls, using local stone where possible, and in particular maintaining and restoring the areas of strong field patterns that retain evidence of medieval field systems.
- Maintain the high quality of the watercourses so that they continue to provide key features within the landscape, of high biodiversity interest, as well as opportunities for fishing and wildlife watching.
- Protect existing broadleaved woodland and manage them through encouraging natural regeneration, to ensure long term contribution of woodlands to the landscape and their biodiversity interest.
- Buffer and extend small broadleaved woodlands and look for ways of connecting with other semi-natural habitats, especially other woodlands.
- Manage mixed and coniferous plantations through increasing the proportion of native broadleaved species, encouraging the development of a rich ground flora, and improving their outlines and relationship to local landform, to enhance their landscape and biodiversity value.
- Ensure that biodiversity interest of road verges is surveyed and recorded, and that management is appropriate for the protection and enhancement of the flower-rich verges.
- Protect historical villages and their central greens and tofts, and ensure that new development or conversions are carried out in a sympathetic way, using appropriate materials and styles and protecting the integrity of historic buildings and features.
- Protect the many archaeological features both above and below ground, including stone circles, burial mounds, lynchets, ridge and furrow, settlement evidence and tracks, and provide interpretation where appropriate to raise awareness of the history and time depth of the area.

- Protect and maintain features such as lime kilns, field barns, disused quarries and sheepfolds, along with the historic settlements and field patterns, which reflect past settlement patterns and farming practices.
- Provide interpretation of the underlying geology, with its combinations of striking karst and other geological features, along with its rich historic interest, current agricultural uses and biodiversity values.
- Find ways of providing interpretation of the many and distinctive qualities of the landscape for those visiting, to improve their understanding and enjoyment of the high-quality natural environment on which their recreational activities depend.
- Protect sense of remoteness and tranquillity by controlling development, especially on open fells, and the use of night-time lighting.
- Support quiet recreation such as walking, cycling, riding, wildlife watching, heritage tourism that benefits from and values the high quality of the natural environment.
- Provide easily accessible sites of wildlife, historical and geological interest for educational use.
- Engage volunteers with the tasks of conserving the extensive wildlife, historical and geological interest of the area, to increase enjoyment and understanding of the natural environment.

Lowther Castle, built on a site occupied since early medieval times, was completed in the early 19th century. Subject to many changes since then, the Castle and its parkland have recently been restored and now form a major visitor attraction in the north of the area.

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	Livestock rearing Dairy farming Grades 3, 4 and 5 agricultural land	Two thirds of the farms focus on livestock grazing, with over 170,000 sheep and 22,200 cattle (in 2009). Dairy farms make up 16 per cent of the holdings. Half of the farmed land is Grade 4, with only 18 per cent Grade 3 (mostly in the north and north west), and 32 per cent Grade 5 (on the high land of the limestone plateau).	Regional	With relatively cool temperatures and high rainfall, there are constraints as to the type of agricultural practice possible here. Numbers of both sheep and cattle were much reduced by the outbreak of foot and mouth disease in 2001, but have now largely recovered. There may be some potential for further increasing the numbers of livestock generally, although the increase in manure and slurry would need to be managed to avoid reduction of water quality. In particular there could be an increase in cattle grazing the fells and limestone grasslands. Hardy beef cattle are useful for grazing upland fell vegetation, along with sheep, as they are less selective in their grazing. **Continued over...**	Encourage sustainable levels of grazing by hardy beef cattle, along with sheep, on the upland fells, thus ensuring good ecological condition of both upland heath and calcareous grassland, and protection of underlying soils, especially peaty soils. Encourage the uptake of agri-environment schemes to support sustainable livestock production including the management of meadows for hay, to protect and enhance their species richness. Support farmers in promoting high-quality local meat and other produce, in particular from hardy beef cattle, and linking the livestock production to the high environmental value of the area. **Continued over...**	**Food provision** **Sense of place/ inspiration** **Regulating soil quality** **Regulating water quality**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Food provision continued				**...continued from previous** Promotion of local brands, especially of beef, would support this local farming practice. Levels of stock would need to be managed carefully to encourage good ecological condition of the mosaics of upland heath and calcareous grasslands, while avoiding poaching of soils or erosion of stream banks that would result in sediment entering the watercourses. The production of locally sourced food can not only support local farming, but also contribute to the conservation of semi-natural habitats and to tourism, thus developing a more sustainable green economy.	**...continued from previous** Promote the use of new technologies and best practice in the production of food while reducing detrimental impacts on the natural environment.	
Timber provision	Woodlands – small conifer plantations, broadleaved woodlands	There are only 500 ha broadleaved, 639 ha conifers, and 97 ha mixed woodlands, giving a total of 4.8 per cent woodland cover. Much of the broadleaved woodland is found on steep valley sides or in small copses associated with farmsteads. There are several conifer and mixed plantations in the north and north-west, providing both shelter and shooting interest.	Local	With only very limited woodland cover, of relatively small plantations dispersed through the north and north-west of the area, there is only a limited timber industry in the area. With thin soils on the limestone, there is also little potential for the further production of timber. Existing woodlands and shelterbelts could be managed more effectively to produce timber and wood fuel for local use.	Ensure that existing conifer, mixed and broadleaved woodlands are brought into sound management to increase the production of timber, including wood fuel for local use. Manage conifer plantations through thinning, selective felling and re-shaping, taking opportunities to increase the proportion of broadleaves within them, to improve the production of timber as well as the contribution they make to the local landscape and to biodiversity interest.	**Timber provision** **Biomass energy** **Sense of place/ inspiration** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability	Several rivers including the Lowther, Lyvennet and Lune Peaty soils underlying upland heath	The NCA does not overlay any major aquifers. Rivers in the NCA that form part of the River Eden catchment generally have 'water available' status with the exception of the River Leith, a tributary of the Lyvennet, which has 'no water available'.[7] The Haweswater Reservoir (on the river Lowther but upstream in Cumbria High Fells NCA) supplies about a quarter of the public water supply for the north-west of England, including via a system of aqueducts to Manchester and the surrounding area. The upper stretches of the Lune have only restricted water availability.[8] Peaty soils cover approximately 13 per cent of the area, generally underlying upland heath.	Regional	The Environment Agency is looking at ways of reducing the impact of abstraction from Haweswater Reservoir on the rest of the catchment; below the reservoir the Lowther flows through the Orton Fells NCA to join the River Eden.[9] Industrial abstractions from the Lune tend to be located further south in the catchment, near Lancaster. Over recent years there has been a reduction in industrial abstraction from the Lune due to the shift away from industry and the change in land use along the Lune river corridor.[10] The potential for further abstraction from the Lune and its tributaries for industry, agriculture and fish farming is relatively limited, and drought arising from climate change would put further pressure on water supply from this river. Measures to ensure good ecological condition of the peatland habitats that occur on the higher land, so that there are mires and good bryophyte component within upland heath, would increase the ability of the land to intercept and retain rainwater. This would also reduce soil oxidation and erosion, the discolouration of water, and contribute towards carbon storage, flood mitigation and increased drought resilience.	Ensure that any further abstraction is carefully controlled to avoid impacting on the international biodiversity interest of the Lowther and other tributaries of the Eden, and on the limited resources of the Lune. Ensure that the areas of upland heath are under grazing regimes that will encourage good ecological condition and improve the interception of rainwater. Ensure that areas of blanket bog and wet heath are under grazing regimes that will allow for active peat formation, to better intercept and retain rainwater.	**Water availability** **Regulating water quality** **Regulating water flow** **Regulating soil quality** **Regulating soil erosion** **Sense of place / inspiration** **Recreation** **Biodiversity**

[7, 9] *The Eden and Esk Catchment Abstraction Management Strategy*, Environment Agency (February 2013; URL: www.environment-agency.gov.uk/business/topics/water/119927.aspx)

[8, 10] *Lune and Wyre Abstraction Licensing Strategy*, Environment Agency (February 2013; 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	N/A					
Biomass energy	Existing woodland	The existing woodlands are generally small and dispersed, covering only 4.8 per cent of the area, of which just 2 per cent is conifers.	Local	The area has generally medium potential yield for both short rotation coppice and miscanthus. However, planting of either would be likely to be obtrusive and out of character in such an open area of moorland and pastures. It is more akin to arable cropping which is generally not carried out in this area, and there are few local sources of demand. For further information on the potential landscape impacts of biomass plantings within the NCA refer to the tables on the Natural England website.[11] There may be some potential for increasing the provision of wood fuel either as a by-product of timber production, where that occurs, or through bringing under-managed woodlands into management. Active management would create opportunities to buffer and extend fragmented woodlands, protect and improve the underlying soils, increase carbon capture, and enhance biodiversity.	Bring existing conifer plantations, shelterbelts and broadleaved woodlands under management that will increase the production of biomass/ wood fuel for local use, while also increasing carbon capture, improving underlying soils and enhancing biodiversity interest.	**Biomass energy** **Timber provision** **Climate regulation** **Regulating soil quality** **Sense of place / inspiration** **Biodiversity**

[11] www.naturalengland.org.uk/ourwork/farming/funding/ecs/sitings/areas/default.aspx

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation	Woodlands Peaty soils	With 85 per cent of the area covered by mineral soils, soil carbon levels are generally low (0–5 per cent). Higher soil carbon levels are found in the peaty soils on the plateau where they are associated with upland heath. Carbon storage is also provided by the floodplain soils with naturally high groundwater (2 per cent) and by the woodland cover within the NCA.	Local	The peaty soils that cover some 13 per cent of the area need to be well vegetated, in good ecological condition and protected from drying out or other damage that would leave them vulnerable to oxidation and wind and water erosion. Sequestration of carbon would be increased if active peat formation could be encouraged especially in the small pockets of blanket bog. This is particularly important with the increase in frequency and intensity of rainfall events, and possible drier summers, as a consequence of climate change. However, should summer droughts become more frequent, then the calcareous soils do have a degree of resistance to drought, and support drought-resistant species on the free-draining limestone. Increases in summer temperatures and drought could impact on the rivers, reducing the water quality and giving rise to stressful conditions for fish species. **Continued over...**	Ensure that upland heath and the small pockets of blanket bogs are managed to encourage good ecological condition and active peat formation where possible, avoiding burning and managing levels of grazing stock, to improve carbon storage. Promote extensive grazing on pastures, with greater use of manures, reducing or eliminating applications of artificial fertiliser where possible, to encourage the build up of organic matter. Seek opportunities to extend the areas of semi-natural habitats and permanent grassland under low input management. Seek opportunities to expand the area of woodland in appropriate locations, such as on steep sides of narrow gills, along river banks, and associated with villages and farmsteads, while retaining the open character of the landscape and avoiding impacts on archaeological or biodiversity interest.	**Climate regulation** **Regulation of soil erosion** **Regulation of soil quality** **Sense of place/ inspiration** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation continued				**...continued from previous.** Semi-natural habitats and permanent grassland allow for the build up of organic matter within the soils. Extensive grazing systems with low inputs would avoid soil compaction and enable the reduction or elimination of the use of artificial fertilisers, both of which release nitrous oxide. Sequestration of carbon could also be increased by ensuring that all woodlands are under sound management, and by extending the area of tree cover. The location of new woodland needs to be considered carefully, to avoid reducing the open character of the landscape, or adversely impacting on biodiversity interest or archaeological earthworks and other historic features.		

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	Rivers, especially the Lune and its tributaries, and the tributaries of the Eden Semi-natural habitats Free-draining slightly acid loamy soils	The River Eden, with its several tributaries rising from the Orton Fells, is a naturally base-rich river system with high-quality water. It is designated as a Special Area of Conservation, for the wide range of ecological conditions which support a diverse range of plant and animal communities. The ecological status of the tributaries of the River Eden within the NCA is good with the exception of the River Lowther which is moderate. The ecological status of the River Lune within the NCA is good while its chemical status is not assessed.[12] The chemical status of groundwater underlying the upper Lune catchment is poor while that underlying the Eden catchment is good although neither form part of a major aquifer here.[13,14] The River Eden and its tributaries are within a priority catchment area under the Catchment Sensitive Farming Delivery Initiative. Soil erosion is identified as an issue within these catchments, as are high phosphate levels in the rivers.	Regional	With the relatively high rainfall, and sloping ground, soil erosion can be an issue along the active upland streams, carrying pollutants as well as sediment into the watercourses. This is especially so in the farmed areas on lower-lying land where more intensive dairy and livestock rearing are carried out. The possible increased frequency and intensity of rainfall events due to climate change will only exacerbate this situation. Erosion from fast-flowing water can be moderated by ensuring that slopes and land adjacent to watercourses are under permanent vegetative cover such as grassland or scrub, which both bind the soil and improve infiltration rates. Springs and flushes from calcareous outflows on the fells, forming the headwaters of the high value river systems, can be vulnerable to overgrazing. They are also affected by being used for watering livestock, and modification for drainage. On farm land, careful soil management is required such as avoiding mechanised activities on wet soils that cause compaction, and reducing levels of livestock grazing to avoid poaching. **Continued over...**	Encourage establishment of riparian habitats, especially permanent unfertilised grassland, by fencing stock out and managing to ensure good swards, to reduce poaching of banks, soil erosion and subsequent sedimentation of the watercourse, and also pollution from nutrients. Protect the springs and flushes at the headwaters of the river systems from damage by grazing livestock, and from modification for livestock drinking water supply or drainage. Manage blanket bog, wet and dry heath so that a variety of bryophytes and other vegetation is maintained by extensive sheep and cattle grazing, to avoid exposure of peat and peaty soils which would make them vulnerable to erosion by wind and rain. On improved grasslands, encourage low input livestock systems, and manage applications of slurry and manure to maximise uptake and reduce run-off. **Continued over...**	**Regulating water quality** **Climate regulation** **Regulating soil erosion** **Sense of place / inspiration** **Recreation** **Biodiversity**

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

[13] *North West River Basin Management Plan*, Environment Agency (December 2009; URL: www.environment-agency.gov.uk/research/planning/33106.aspx)

[14] *The River Basin Management Plan for the Solway Tweed River Basin District 2009–2015*, Environment Agency and Scottish Environment Protection Agency (SEPA) (December 2009; URL: www.sepa.org.uk/water/river_basin_planning.aspx)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality continued				**...continued from previous.** Phosphate levels in the rivers can be high, and are attributable both to soil erosion and to high levels of inorganic phosphate application, along with poor slurry and manure management on farmland. With increasing rainfall, and intense storm events, slurry storage can reach capacity in a short period of time, thus putting pressure on farmers to spread slurry perhaps at inappropriate times. This can be addressed through improved manure management, such as separating out grey water in the farmyard, ensuring adequate and roofed slurry storage capacity, and avoiding manure spreading in winter on frozen or hard ground, and when there is no grass growth, or on very wet ground. Matching the nutrient inputs to need can also assist. Improved soil structure, including an increase in organic matter, would improve infiltration of rainwater, thus recharging groundwater supplies. The soils have potential for increased organic matter levels through management interventions such as reducing levels of grazing and limiting applications of artificial fertiliser. Other measures being taken include rural sewerage schemes to replace septic tanks, especially in the Leith valley, to reduce phosphate levels.[15]	**...continued from previous.** Address nutrient inputs and match to needs as far as possible. Manage levels of grazing to maintain good soil structure thus aiding infiltration of rainwater and reducing direct run-off into watercourses. Encourage farmers to improve facilities for the storage of slurry and manure, sufficient to cope with more extreme weather conditions, and to avoid spreading manure on saturated or hard ground.	

[15] *Solway Tweed Measures Report*, Environment Agency and SEPA (2012; URL: www.sepa.org.uk/water/river_basin_planning.aspx)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow	Several major rivers and tributaries of the Eden and Lune, including the Lowther, Lyvennet, Hoff Beck and Scandal Beck Permeable limestone bedrock Permanent grassland Semi-natural habitats	The majority of the rivers within this NCA form the headwaters of the River Eden, which also drains parts of the Lake District fells and Yorkshire Dales. The steep gradients and high rainfall, with relatively impermeable geology in the Lakes and Dales, combine to produce large and rapid flow events in these upland streams. There is little flood risk to people or property within the NCA, due to its rural and sparsely populated nature. However, flood risk does occur downstream in the steep middle course at Appleby, Warwick Bridge and Wetheral (in Eden Valley NCA), and at Penrith on the Petteril and Lowther. There is also significant fluvial flood risk further downstream in Carlisle, where major flooding occurred in 2005 and 2009.[16] The headwaters of the River Lune, which have their source in the Howgill Fells NCA, flow through the south-west of this NCA. Downstream flood risk exists in Halton (Morecambe Bay Limestones NCA) and Lancaster (Morecambe Coast and Lune Estuary NCA) on the lower Lune, as well as affecting low lying agricultural land.[17]	Regional	The increased frequency and intensity of storm events arising from climate change are likely to exacerbate the flash flood flows of the upland streams, although within this area the underlying permeable limestone will moderate the flows to an extent. Ensuring good condition of the mosaics of habitats on the fells, with areas of upland wet and dry heath, calcareous and acid grassland, can assist with intercepting rainwater, improve infiltration and thus mitigate the flows of water off the fells. Creation of woodland and scrub can also improve infiltration of rainwater, and where adjacent to watercourses and within flood plains, can impede the flow of floodwaters. Where livestock are reared more intensively, then grazing levels need to be managed, as well as avoiding the use of heavy machinery in wet conditions, to avoid compaction and poaching of soils, both of which reduce infiltration of rainwater resulting in more rapid run-off. With the underlying permeable limestone, and relatively narrow valleys, especially in the upper tributaries of the river Eden catchment, the scope for increasing flood storage or the holding capacity of floodplains may be limited, other than within the wider lower reaches of the Lune. The emphasis therefore is on the management of the farmed land and semi-natural habitats to intercept and capture rainwater more effectively.	Manage the mosaic of upland wet and dry heath, calcareous grassland and acid grassland so that good ecological condition is achieved and maintained by extensive sheep and cattle grazing, to intercept rainwater, improve rainwater infiltration and slow down run-off. Seek opportunities to increase the area of flood storage especially within the Lune Valley, and establish wet pastures, fens and other wetland habitats. Allow the rivers to follow more natural courses, thus diffusing the energy of flood flows. Establish woodlands along lower reaches of the rivers, where this can effectively slow the flow of floodwater. Encourage more extensive grazing management, protecting wet soils from heavy grazing and from compaction through the use of heavy machinery, to improve infiltration of rainwater. Seek opportunities to increase flood storage within the lower, flatter, stretches of the valleys, especially the Lune.	**Regulating water flow** **Regulating soil erosion** **Regulating water quality** **Sense of place / inspiration** **Biodiversity**

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

[17] *Lune 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 soil quality	Soils Land management practices	This NCA has seven main soilscape types: freely draining slightly acid but base-rich soils, covering 38 per cent of the NCA; slowly permeable seasonally wet acid loamy and clayey soils (27 per cent); freely draining, slightly acid loamy soils (16 per cent); very acid loamy upland soils with a wet peaty surface (8 per cent); slowly permeable wet very acid upland soils with a peaty surface (5 per cent); slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (4 per cent); and loamy and clayey floodplain soils with naturally high groundwater (2 per cent).	Local	With the freely draining slightly acid but base-rich soils, where calcareous horizons are near the surface these help provide some natural resilience and enhanced workability, although some areas are at risk from topsoil compaction and poaching. Careful management of weak topsoils, including increasing the content of organic matter, will help to maintain a good soil structure. The slowly permeable, seasonally wet, acid loamy and clayey soils may suffer compaction and/or capping as they are easily damaged when wet. In turn this may lead to increasingly poor water infiltration and diffuse pollution as a result of surface water run-off. Again, management measures that increase organic matter levels can help reduce these problems, as can careful management of grazing levels to avoid overgrazing which can cause compaction, and poaching when soils are wet. The freely draining slightly acid loamy soils allow water infiltration and have potential for increased organic matter levels through management interventions. They may be valuable for groundwater recharge requiring the maintenance of good structural conditions to aid water infiltration and requiring the matching of nutrients to needs to prevent pollution of the underlying groundwater. The peaty soils need to be managed through extensive grazing regimes, thus ensuring that they retain water and good vegetative cover, to prevent the peat from drying out and becoming vulnerable to erosion from wind or water.	Manage grazing levels, especially when soils are wet, to avoid overgrazing leading to compaction and poaching. Encourage extensive livestock systems, to reduce inputs of artificial fertilisers thus enabling organic content to build up. Return organic matter and manure to soils to maintain its fertility, encourage build up of organic matter and reduce the reliance upon artificial fertilisers. Plan cultivation timings carefully and avoid using heavy machinery on wet soils to prevent compaction and damage to topsoils. This will also improve the infiltration of rainwater thus reducing surface run-off. Manage grazing of heath and peaty soils to ensure that good vegetative cover is maintained, and manage the water table levels, to protect the peat from drying out and oxidising, as well as protecting the palaeo-environmental evidence within it. Manage the inputs of nutrients on grasslands to meet needs as far as possible.	**Regulating soil quality** **Regulating water quality** **Regulating water flow** **Regulating soil erosion** **Regulating climate change** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil erosion	Soils	Soils covering 67 per cent of this NCA are susceptible to erosion. These include the freely draining slightly acid but base-rich soils (38 per cent), the freely draining slightly acid loamy soils (16 per cent), the slowly permeable wet very acid upland soils with a peaty surface (5 per cent), and the very acid loamy upland soils with a wet peaty surface (8 per cent). The remaining, mainly slowly permeable soils carry a low erosion risk. The River Eden and tributaries is a priority catchment under the Catchment Sensitive Farming Delivery Initiative.	Regional	The freely draining slightly acid but base rich soils are susceptible to capping and slaking, which increase erosion by surface run-off of rainwater. Timing of cultivation and avoiding the use of heavy machinery when wet will avoid compaction. The freely draining slightly acid loamy soils erode easily on steep slopes, especially where vegetation is removed, with potential for wind erosion where coarse textured soils are cultivated. There is a need for careful timing of cultivation such as reseeding, maintaining continuous vegetation cover as far as possible, especially on sloping ground. The slowly permeable wet very acid upland soils with a peaty surface on the higher land of the plateau are at risk of gullying and hagging, and loss of particulate organic matter, where vegetation is lost or damaged. Drainage of these soils can also result in increased oxidation of the peat. **Continued over...**	On the lower-lying land, and within the valleys, where grassland management is more intense, encourage careful timing of cultivation, such as the re-seeding of grasslands, and the use of heavy machinery, to avoid compacting or damaging topsoils, thus reducing run-off and sedimentation of watercourses. Encourage extensive grazing systems and limit nutrient inputs to manure, to enable the organic content of soils to build up, thus improving infiltration and reducing rapid run-off. Throughout, ensure that watercourses are protected by buffer strips of permanent, unfertilised, grassland or scrub, to capture sediment. Provide watering points and keep livestock away from the banks of watercourses to prevent trampling and damage to the banks, which can lead to increased sediment input to watercourses. **Continued over...**	**Regulating soil erosion** **Regulating soil quality** **Regulating water quality** **Regulating water flow** **Climate regulation**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil erosion continued				**...continued from previous.** Erosion is particularly prevalent on the very acid loamy upland soils with a wet peaty surface often found on steep slopes, where a combination of rapid run-off and easily damaged peat layers results in soil erosion. Here measures that retain water levels and encourage good vegetative cover, such as carefully managing grazing levels, will protect the peat and prevent it becoming vulnerable to both wind and water erosion. Encouraging sustainable land management practices, such as extensive grazing systems that avoid overgrazing, reduction of trampling and poaching, especially stock damage to river banks, and damage by mechanised activities, will reduce soil erosion, as well as improving water quality.	**...continued from previous.** Encourage extensive grazing systems with careful management of livestock numbers, especially when soils are wet, to reduce trampling and poaching. On the fells, manage grazing of heath on peaty soils to ensure that a good vegetative cover is maintained, and where possible keep the water table levels high, which will protect the peat from drying out and oxidising, making it vulnerable to both wind and water erosion, as well as protecting the palaeo-environmental evidence within it.	

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pollination	Species-rich limestone grasslands Upland hay meadows Other unimproved grasslands Road verges Upland heath	Upland heath and unimproved grassland habitats, including herb-rich calcareous grasslands, hay meadows and road verges, cover nearly 3,000 ha and these will all provide important nectar sources for pollinating insects.	Local	The area is predominantly used for grazing and grass production, so the need for insects to pollinate commercial crops is not a major issue here. However the semi-natural habitats, in particular the species-rich hay meadows and road verges, will provide important feeding and breeding locations for a wide range of pollinating insects.	Support farming practices that maintain and enhance the range of habitats including upland heath, calcareous grassland, species-rich hay meadows and pastures. Manage the wide road and track verges to ensure that their species-rich plant communities are maintained and extended, thus providing a network of sources of food for pollinating insects through the area.	**Pollination** **Biodiversity** **Sense of place/ inspiration**
Pest regulation	Native broadleaved woodlands	Many of the small, fragmented broadleaved woodlands, copses sheltering farmsteads and small trees on boundaries on the fells are ash.	Regional	Ash die-back *Chalara fraxinea* was identified in England in 2012. The loss of the widespread ash woodlands and ash trees in this area would have a very high impact on both the landscape character and biodiversity interest. The sound management of woodlands, including natural regeneration, to ensure both healthy trees and the generation of new strains that might be more resilient to the disease should be encouraged. Efforts could be made to identify any naturally resistant strains, and propagate local provenance from them.	Ensure that ash woodlands are under sound management, with natural regeneration of ash and other native species. Encourage landowners and interest groups to survey and monitor the incidence of the disease, and identify naturally resistant strains.	**Pest regulation.** **Sense of place / inspiration** **Biodiversity** **Timber provision**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of place/ inspiration	Limestone geology Upland fells with long views out to surrounding uplands Calcareous grasslands River valleys Quiet villages Use of local materials for farms, houses and community buildings	A sense of place is created by the open and exposed fells, with the distinctive limestone features of outcrops, pavements and screes alongside heath and limestone grasslands. The fells are surrounded by pastoral farmland with distinctive villages following springlines and dispersed farmsteads, all built of local limestone, and all retaining considerable historical interest. The valleys with their small active rivers contain improved grasslands bounded by drystone walls. Woodland cover is limited to broadleaved woodland in the narrow gills, mixed or coniferous small woodlands and shelterbelts, copses around farmsteads and isolated windswept trees on the fells. With its open fells, low population and few quiet roads, there is a strong sense of remoteness. The long-distance views across to Cumbria High Fells, the Howgills and the North Pennines further emphasize the feeling of openness and remoteness, and emphasize the contrasts with the villages and enclosed fields of the valleys.	National	The geological structure of this area is particularly distinctive, with its many karst features. This along with its quiet and remote feel give it a strong sense of place, appealing in particular to those interested in wide open spaces, rural upland landscapes and a sense of being close to natural processes. The sense of remoteness is strengthened by the open, exposed fells with the long views out to the dramatic skylines of surrounding uplands. This area has been subject to few development pressures, thus the settlements and vernacular architecture retain a high degree of visual unity and historic integrity. This results in the time depth of the area being very evident which contributes to inspiration and appreciation of the area. On lower-lying land towards the north are a number of small shelterbelts, mostly comprising conifers. These could be made less obtrusive within the rural landscape by increasing the proportion of broadleaves, and encouraging the development of scrub and unimproved grassland around the edges. **Continued over...**	Maintain and restore drystone walls. Maintain sense of remoteness on the fells by protecting the long-distance views and avoiding any inappropriate development. Control development and maintain historic integrity of villages and vernacular architecture. Manage the mosaic of the heathland, with its heath, mires, calcareous and acid grasslands, and protect the extensive stretches of limestone pavement. Maintain and expand the species-rich hay meadows and road verges. Manage the semi-natural woodlands and copses of trees around farmsteads and villages. **Continued over...**	**Sense of place / inspiration** **Sense of history** **Recreation** **Geodiversity** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of place/ inspiration continued				**...continued from previous.** J.M.W. Turner painted several views from the limestone plateau, while contemporary artist Andy Goldsworthy has engaged local craftsmen to construct a number of 'sheepfolds' that link historical land use to geology.	**...continued from previous.** Encourage the management of the small coniferous shelterbelts, to increase the broadleaf component, and establishing scrub and grassland around the edges, improving their form to assimilate them more effectively into the landscape, as well as enhance their biodiversity interest. Provide interpretation of the karst geological features of the landscape. Where appropriate, provide access to and interpretation of sites of wildlife, geological and historical interest, to enable people of all levels of ability and interest to be able to appreciate and be inspired by the landscapes of the area. Provide access to features of historical interest where appropriate, especially the ground features, with interpretation that links them to their wider landscape context, in particular the underlying geology, to improve understanding of the development of the landscape over time.	

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	130 Scheduled Monuments 324 listed buildings Three Registered Parks and Gardens Visible historic evidence at a landscape scale Distinctive settlement patterns Several villages based on medieval layouts Six Conservation Areas Farmsteads, granges Quarries, lime kilns, sheepfolds Settle–Carlisle Railway Conservation Area	The history of this landscape is evident in its distinctive settlement patterns and historic villages, and a wealth of visible archaeological features including bronze-age stone circles, burial mounds, Roman roads, Romano-British settlements, medieval settlements and open field patterns, small quarries, lime kilns, sheepfolds and dry stone walls reflecting medieval field patterns. The villages and farmsteads all retain a high degree of historical integrity. Lowther Castle is a particularly striking historic building, with its surrounding parkland, while Smardale Viaduct, carrying the Settle–Carlisle Railway, is an iconic structure, listed for its historic interest. Historic cultural associations include J.M.W. Turner who painted views from Asby Scar.	National	The lack of significant development, including a lack of ploughing, over time has resulted in the exception retention of clear and visible evidence of features from many periods of history, making it of national significance. Earthworks and ground features are vulnerable to damage by in-field feeding of cattle, poaching by grazing livestock and vehicle damage, and these inappropriate agricultural practices are impacting on some sites. The pattern of nucleated or linear villages located along springlines on fell margins, with strip enclosures (tofts) to the rear of properties, droveways leading onto common land, and medieval field patterns all reflect the long history of pastoral farming. Good examples of medieval open field systems survive in the wall patterns near Maulds Meaburn and Great Asby. At Waitby and Smardale there are particularly fine examples of medieval settlements and remains of early parkland features such as pillow mounds. Many of the isolated farmsteads have survived from shrinkage or abandonment of medieval villages. A large number of traditional farmsteads have survived, and their significance is heightened by the fact that the farmsteads and working buildings, including field barns, sit within a landscape which retains visible evidence of historic land use and settlement. **Continued over...**	Identify and protect the extensive settlement evidence and field patterns that create distinctive historic landscapes, such as at Waitby and Smardale, and provide interpretation. Encourage the use of appropriate local building materials and styles when restoring or converting vernacular buildings. Encourage the maintenance and restoration of drystone walls, using appropriate styles and techniques according to their historic interest. Develop plans for the conservation of features of historic interest, especially within the Conservation Areas, and provide interpretation to improve understanding and enjoyment of the heritage assets. Identify, restore and maintain the many utilitarian features such as lime kilns, field barns and sheepfolds. Seek ways of reducing grazing pressure and vehicle access where this is damaging ground features or artefacts.	**Sense of history** **Sense of place / inspiration** **Recreation** **Geodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history continued				**...continued from previous.** The survival of 18th-century working buildings is higher here than in the Yorkshire Dales or Howgills. There are also many farmsteads which show different stages of development over time, including longhouses, and small-scale farms and smallholdings next to areas of historic common land. Many of these farm buildings remain unconverted, with a high level of historic integrity, although some are showing signs of structural disrepair, especially the field barns.[18] Similarly there are many examples of vernacular architecture within the villages. Restoration and conversion of historic buildings should retain key historic features and use appropriate building materials and styles, to retain their integrity. Throughout the area there are features that reveal historic land uses, including small quarries, field barns, lime kilns and sheepfolds, many of which require maintenance or restoration. The entire length of the Settle–Carlisle Railway line has been designated a Conservation Area for its important historic role and its classic railway architecture and heritage features. The rich evidence of historic periods makes it possible to 'read' the history of the landscape, its settlement and uses over time, and interpretation of the links between geology, history and past and current land uses can increase understanding and enjoyment of the landscape.		

[18] *Photo Image Project*, English Heritage (2006)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Tranquillity	Open fells of heath and grassland with long views out in all directions Quiet rural valleys with widely dispersed farmsteads Few settlements generally small in size Roads with little traffic Dark night skies	The area is generally very tranquil, with lower levels of tranquillity associated with the main roads and quarries in the far west. Undisturbed areas have decreased from 96 per cent in the 1960s to 74 per cent in 2007.	National	Tranquil areas are important in delivering health and well-being benefits to visitors, with close contact to natural features also providing good sensory environments for relaxation which has a calming and restorative effect on mental well-being. The fells, with no settlements and few farms, are very tranquil. The farmed land of the fringes and the valleys are quiet, with widely dispersed farmsteads, few, small, dispersed villages and a limited network of minor roads. The increase in disturbance since the 1960s is limited to the effects of the transport corridor along the west side, which includes the M6 and railway. Because of the landform, the effects of this disturbance are largely contained within the valley. As a consequence of the low population, the night skies are relatively very dark.	Protect the fells from development that would reduce the level of tranquillity and perceived remoteness. Retain quiet rural nature of villages through maintaining the dispersed settlement pattern and ensuring that any new development is constrained to villages and is in scale and appropriate in terms of materials and styles to be assimilated into the built environment of the village. Control lighting in new developments and conversions, for example by using timers and sensors, to reduce light pollution.	**Tranquillity** **Recreation** **Sense of place / inspiration**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation	Exceptional long-distance views from plateau Open access land Public rights of way Quiet rural roads Pennine Bridleway National Trail Coast to Coast Walk Walney to Wear cycle route Rich and evident cultural heritage	The NCA offers a network of rights of way at a density of just over 1.4 km per km^2 as well as 22 km of the Pennine Bridleway National Trail, which goes from the Lune Valley cutting across Ash Fell to Soulby. There is also a good network of quiet roads, while the disused South Durham and Lancashire Union railway provides accessible trails, including over the Smardale Gill viaduct. Open access land covers 25 per cent of the area, and there are 351 ha of accessible National Nature Reserve. The Pennine Bridleway runs from Bowerdale in the Lune Valley across Ash Fell to Soulby. The popular Coast to Coast Walk and Walney to Wear cycle route also cross the area. Local routes include Lady Ann Clifford's Way and Wainwright's 'A Pennine Journey'.	National	There is relatively easy access to the fells which offer the experience of wild and remote landscapes popular with walkers and birdwatchers. The open countryside also provides scope for paragliding and hang gliding. The footpaths provide good networks for walkers, while the long minor roads and tracks, often with wide verges, provide plenty of scope for walking, cycling and horse riding. Further access provision could focus on enabling people of all levels of ability to access and enjoy the natural environment. The quiet pastoral valleys, with their historic field patterns and villages, and the narrow wooded valleys with their active upland streams all offer quiet recreation opportunities, including walking, fishing and wildlife watching. Other strengths of the area include the geological features of the area and its many heritage assets, again often encountered through walking or cycling. This area is of particular significance for the opportunities it offers for close contact with tranquil and sensory environments, which has a calming and restorative effect on people's health and wellbeing. The small woodlands and clear upland rivers provide shooting and angling opportunities within a high-quality environment. There is grouse shooting on some of the upland heaths.	Maintain the open, exposed and remote experiences of the fells for the enjoyment and inspiration of visitors, through avoiding introduction of built artefacts. Provide access where possible for people of all abilities and interest to be able to appreciate and be inspired by the landscape. Encourage quiet recreational activities that support and benefit from the high-quality rural environment, such as walking, cycling, horse riding, wildlife watching, botanising, visiting heritage assets, exploring geological features, and angling, providing for all abilities where possible. Work with local landowners and managers to provide facilities such as accommodation and refreshments for users of long-distance routes, and include discreet and imaginative interpretation of the key features and assets of the area. Work with local tourism organisations and accommodation providers to provide clear and engaging information to all visitors, thus enabling them to learn about and enjoy the distinctive landscape.	**Recreation** **Sense of place / inspiration** **Sense of history** **Geodiversity** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity	3 Special Areas of Conservation 2 National Nature Reserves 19 Sites of Special Scientific Interest 46 Local wildlife sites Upland calcareous grassland and limestone pavements Wet and dry heath Species-rich hay meadows, pastures and road verges Semi-natural broadleaved woodland	11 per cent of the area is designated SAC – Asby Complex, the river Eden and its tributaries, and several North Pennine Dales meadows. These areas overlap with Sites of Special Scientific Interest, which total 13 per cent of the area. Then there are 46 Local sites covering a further 2 per cent of the area. Great Asby Scar and Smardale Gill are National Nature Reserves, covering 1 per cent of the area. Priority habitats in total cover just under 8,000ha (16 per cent of the NCA) and include 1878 ha of upland heath, 815 ha of upland calcareous grassland, 288 ha of broadleaved woodland, 283 ha of limestone pavement, and 106 ha of lowland calcareous grassland.	National	The limestone pavements reveal geomorphological information and archaeological evidence, as well as being of botanical interest, with rich vegetation within the grykes that includes limestone fern and blue moor grass. The underlying geology, relatively high rainfall and past management have given rise to both acidic and calcareous habitats existing in close conjunction on the fells, a particular feature of this area. Carefully managed grazing regimes are required to achieve good condition of the habitats with their diverse flora. This is a particular issue on the 18 per cent of the land which is Common Land, where collaborative working between the commoners will be essential. Where management of upland heath for grouse shooting includes burning, this needs to follow current guidance. There are several species-rich hay meadows in the valleys (some of which form part of the North Pennine Dales SAC), which remain vulnerable to changes in management. There may be potential for encouraging farmers to restore and manage adjacent grasslands, to extend and link the species-rich grasslands, provide buffering and improve their resilience. The wide road verges are particular rich in grassland species here, and should be managed to retain and enhance their biodiversity interest, thus creating connecting links through the landscape. **Continued over...**	Ensure that limestone pavements, with their geomorphological and historic interest, continue to be protected, and their biodiversity interest enhanced through working with landowners on their management, while retaining the sense of open and expansive landscapes and long-distance views. Work with commoners, graziers and other land managers to achieve grazing regimes, of cattle and sheep as appropriate, which will ensure good condition of the mosaics of wet and dry heath, limestone pavement, calcareous and acidic grasslands. Seek ways of consolidating and expanding the areas of heath on peaty soils by managing the grazing regimes. Encourage the management of hay meadows to retain and enhance their biodiversity interest, and seek opportunities to restore and create further hay meadows, in particular establishing groups of meadows. Monitor the botanical interest of the road verges and establish suitable cutting regimes established, to ensure that they remain as a repository of grassland species. **Continued over...**	**Biodiversity** **Sense of place / inspiration** **Tranquillity** **Geodiversity** **Climate regulation** **Regulating water quality** **Regulating soil erosion** **Regulating soil quality**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity continued				**...continued from previous.** The areas of species-rich calcareous grasslands, both on the fells and along some valley sides, need to be protected from scrub encroachment, tree planting or increased intensity of management for grazing. The rivers form important corridors within the pastoral landscape. They will be vulnerable to warmer summers as a result of climate change, which could lead to reduced water levels, eutrophication and heat stress. Establishing scrub and small woodlands adjacent to watercourses can assist by providing patches of shade. Some stretches of the rivers have been modified with hard engineering, weirs or other structures. Restoring rivers to flow more naturally will improve connectivity both within the river and between the river and adjacent land. Other measures under 'Regulating water quality' will assist aquatic species and vegetation, as well as retaining the value of the rivers for angling. The semi-natural and ancient woodlands are typically dominated by ash, but tend to be small and fragmented. Their condition could be improved by ensuring that they are under sound management which could include retaining some deadwood, opening up some glades and encouraging natural regeneration. **Continued over...**	**...continued from previous.** Protect and manage the areas of species-rich calcareous grassland, ensuring that the levels of grazing maintain and enhance the floristic interest and prevent scrub encroachment. Encourage the management of grasslands, especially those adjacent to heath and rough grazing, to create a range of hydrological conditions. Allow rivers to follow more natural processes by removing hard engineering, redundant weirs and other structures. Bring semi-natural woodland into management, leaving patches of deadwood, incorporating open glades, and encouraging natural regeneration, especially of ash. Seek opportunities to buffer, expand and link fragmented woodlands by creating new woodlands, but avoiding damage to historic features and retaining the open character of the fells, with their long-distance views. **Continued over...**	

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity continued				**...continued from previous.** Their resilience would also be enhanced by expanding, buffering and linking them by creating new woodland, using native species and local provenance where possible. There may be possibilities to introduce small copses of native broadleaved species in gills adjacent to the fells, which could attract black grouse in from surrounding uplands. There is also scope for identifying places where plantations can be cleared and restored to heath or grassland, with compensation planting in more appropriate locations. Steps can also be taken to increase the broadleaved component of the several small shelterbelts that occur on lower-lying land in the north, and to carry out thinning to open up the canopy and encourage a richer ground flora; this would also integrate them more effectively into the local landscape. The possible occurrence of ash die-back within the upland ash woodlands needs to be monitored and managed. The biodiversity interest of the extensive areas of managed grassland could be improved by introducing more extensive grazing regimes, with low or nil inputs of fertilisers. This would achieve varying conditions of hydrology and levels of management to would provide waders and other birds with conditions suitable for breeding, feeding and roosting.	**...continued from previous.** Seek opportunities to reduce obtrusiveness of conifer plantations on higher land, to restore heath and grassland and provide compensation planting in more appropriate locations. Enhance the biodiversity interest of the small shelterbelts by establishing more native broadleaves and carrying out thinning. Restrict access to watercourses by livestock and establish semi-natural habitats, in particular unimproved grassland on the higher, more open, land, and scrub and broadleaved woodland on lower-lying land and in valleys. Improve access to the semi-natural habitats, and provide information and interpretation to raise the understanding of the value of the many different habitats within the area, and increase enjoyment by those visiting the area.	

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	Karst features, including extensive limestone pavements, shake holes, outcrops and scars Springs with tufa formation 5 Geological SSSI and 3 mixed interest SSSI 7 Local Geological Sites Large active quarries Small disused quarries and limekilns	There are many typical karst features where the limestone is exposed or close to the surface, such as shake holes, outcrops and scars, but most notable are the extensive stretches of exposed limestone pavement. The many exposures of the underlying rock, in small quarries or in the major quarries at Shap, reveal information about geological processes. Sunbiggin Tarn, a rare marl lake, is considered to be the most important site in Britain for petrifying springs with tufa formation.	National	The extensive natural outcrops and evident karst features, including limestone pavements, are particularly important for studying rocks of the Carboniferous era. While several areas of limestone pavement have been damaged, they retain their geomorphological features as well as considerable botanical interest. Ash Fell Edge is a nationally outstanding geological site, being the global reference location for Ashfell Limestone, as well as having a wide variety of extremely well preserved fossils. This is an important site for the study and understanding of the palaeogeography, stratigraphy and sedimentation of the Lower Carboniferous Period. Access to the petrifying springs at Sunbiggin Tarn needs to be handled very carefully, to avoid damage to the vulnerable emergent vegetation or disturbance to the bird populations. Interpretation at popular stopping points for visitors, rather than close to the tarn, would be more appropriate. The long-distance views to the surrounding uplands provide a unique opportunity to describe and explain the geology of this part of northern England. **Continued over...**	Protect all limestone pavements from any further damage to geomorphological features. Find opportunities to interpret the karst features of the landscape to a wide audience, thus improving their understanding of the processes that have formed the landscape. Protect the long-distance views from the fells on the high limestone plateau, and provide discrete interpretation at appropriate access points (not on the open fells). Support the restoration of modified rivers to more natural routes thus enabling geomorphological processes such as meandering to take place. Provide information about and interpretation of the tufa formations at springs and at Sunbiggin Tarn, at locations that will not cause intrusion or damage to adjacent land. **Continued over...**	**Geodiversity** **Sense of place/ inspiration** **Sense of history** **Biodiversity** **Recreation**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity continued				**...continued from previous.** The quarries at Shap extract limestone (for use in steelmaking), Shap blue granite (used for aggregate) and Shap pink granite (used for high-quality building frontages). There may be possibilities here for providing access and interpretation to improve understanding of the processes that led to the different rock formations. The several exposures of rock in small disused quarries also reveal geological information that can be used for education, to improve understanding of geological processes. The consistent use of local stone for houses within the villages, farmsteads, field barns, drystone walls, lime kilns and other structures gives a high visual unity to the area, as well as making evident the close relationships between geology and man's activities. All these features provide opportunities for interpretation, with access where appropriate, to improve knowledge, understanding and enjoyment of geology and geomorphological processes.	**...continued from previous.** Work with quarry companies to find ways of providing access and interpretation to improve understanding of geological processes. Work with local geologists and others to encourage research, identify further sites of local interest and provide interpretation of the local geology to raise awareness and appreciation. Provide interpretation of the historic uses of local stone including as building stone for farmsteads and the houses in local villages.	

Photo credits

Front cover: Most farms in the Orton Fells rear sheep and cattle in walled meadows and pastures, with dispersed farmsteads and a few small villages, all linked by quiet roads and tracks. This view is from Little Kinmond looking west towards the Lake District. © Simon Warner/Natural England

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