National Character Area profile:

10. North Pennines

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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.

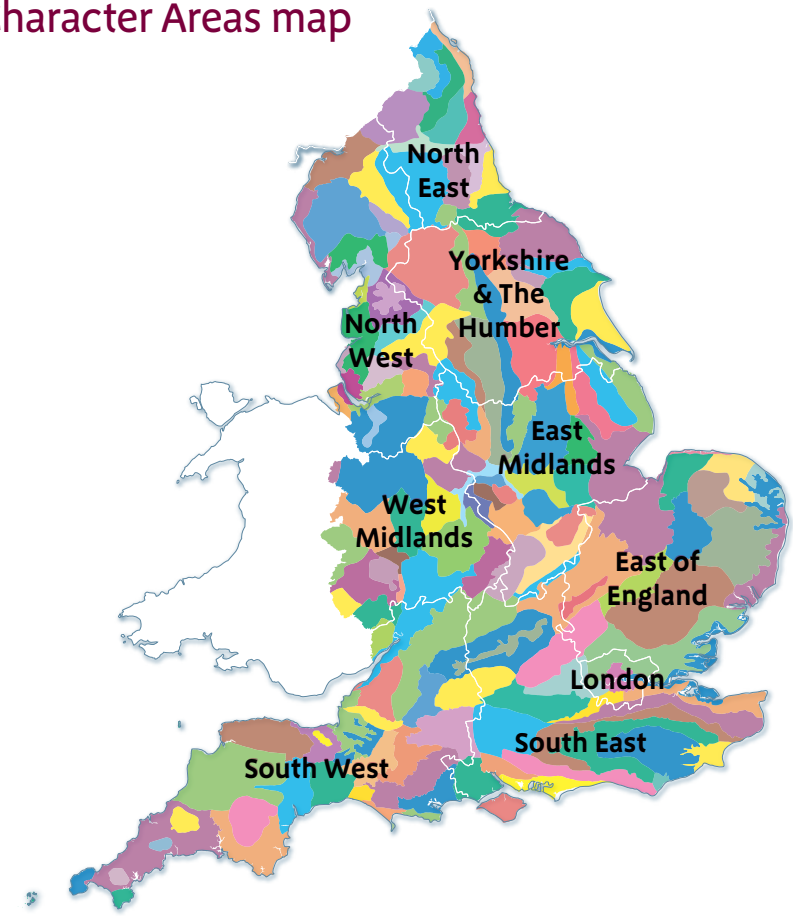
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and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

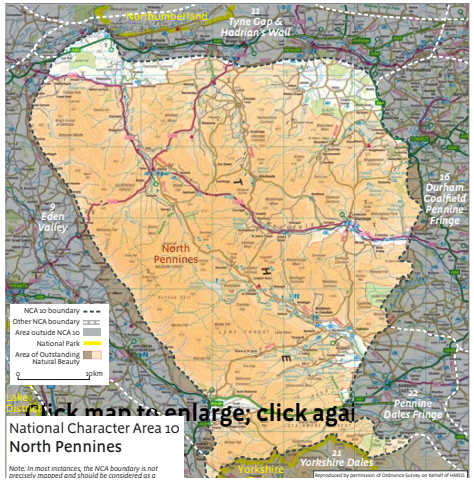
Summary

The North Pennines National Character Area (NCA), at the northern end of the Pennine ridge, has a distinct identity, with its remote upland moorlands divided by quiet dales. It is characterised by a sense of remoteness, with few settlements, slow change and cultural continuity. It comprises some of the highest and most exposed moorland summits in England, with several major rivers, including the South Tyne, Wear and Tees, draining out to the north, east and south-east. It is bordered to the west by the Eden valley, to the north by the Tyne valley, to the east by the Durham lowlands and to the south by the Yorkshire Dales. There are dramatic and panoramic views both across the moorlands and outwards, especially towards the west. The area's natural beauty is reflected in the fact that 88 per cent of it has been designated as the North Pennines Area of Outstanding Natural Beauty (AONB).

The geology of the North Pennines is internationally significant, with the area being designated as a UNESCO European and Global Geopark. The largely Carboniferous rocks with mineral veins have given rise to a long history of mining and quarrying. Intrusions of igneous rock (Whin Sill) form dramatic outcrops with iconic waterfalls. The mosaics of moorland habitat are of international significance, with 46 per cent of the area designated Special Protection Areas (SPA) for the populations of birds such as merlin, black and red grouse, ring ouzel and golden plover. The peat soils underlying the moorland habitats, especially blanket bog, store significant volumes of carbon. Special Areas of Conservation (SAC) cover 44 per cent of the NCA, and include upland heath, blanket bog, rare assemblages of arctic-alpine plants, species-rich grasslands, rivers, woodlands and freshwater habitats.

This is a largely undisturbed landscape, with sheep and cattle rearing the predominant farming practice over centuries. There are few villages, and dispersed hamlets and farmsteads, mostly built with local stone. There is widespread evidence of a long history of mining, and the conservation and interpretation of historic landscapes and geological features provide key opportunities for future environmental management. With its strong sense of wildness and remoteness, and its tranquillity, the area provides an important setting for outdoor recreation, including walking, riding, fishing, canoeing, grouse shooting, birdwatching and star gazing.

Future challenges for the area include the continued management of the land that enables the restoration and enhancement of important habitats, especially blanket bog, heath, calcareous grasslands, upland hay meadows, calamarian grasslands, and broadleaved woodland and scrub – especially juniper. With its high rainfall and impervious rocks, it is an important area for water supply and regulation, and there are opportunities to continue improving water quality and managing water flows to reduce downstream flood events.



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Statements of Environmental Opportunities:

- **SEO 1:** Protect, manage and enhance the moorlands and moorland fringes of the North Pennines, with their internationally important habitats and wildlife, their sense of wildness and remoteness, and the contribution they make to climate mitigation, water quality and availability, and water flow.

- **SEO 2:** Protect, manage and conserve the distinctive historic and geological environment and features of this area, providing access and recreation along with imaginative interpretation, to improve understanding of the landscape and its cultural development.

- **SEO 3:** Manage and enhance the pastoral character of the broad dales, with their patchworks of pastures and meadows, their strong field patterns defined by drystone walls, and their stone-built field barns, farmsteads and small villages – to strengthen local distinctiveness, and to contribute to food provision, climate change mitigation, the conservation and connectivity of important habitats and the sense of history.

- **SEO 4:** Manage the diverse streams, becks, rivers and reservoirs to maintain their high water quality, enhance their biodiversity interest, and strengthen their contribution to the landscape character and recreational opportunities of the North Pennines, while managing water flows and maintaining water supplies.

Fast flowing streams and becks with high quality clean water are a feature of the area, and support a range of freshwater habitats and species. Small and sheltered gills such as this one at Ashgill contrast with the wide open spaces of the fells, and provide opportunities for angling and wildlife watching.

Description

Physical and functional links to other National Character Areas

The North Pennines National Character Area (NCA) lies at the northern end of the Pennines and forms a distinct area of upland moorland and dales, separated by the Tyne Gap from the uplands of the Border Moors and Forests NCA. To the south lie the Yorkshire Dales, and to the west lies the broad valley of the river Eden. The upland fringe landscapes of the Durham Coalfield Pennine Fringe NCA and the Pennine Dales Fringe NCA lie to the east. The western half of the area is characterised by massive moorland summits: in clear conditions, the views to the west (over the Eden Valley to the Cumbria High Fells NCA) and to the east (across the dales) are dramatic. The scarp along the west side also forms a striking backdrop to views from the Eden Valley.

Several major rivers rise in this upland block and flow outwards, to either the North Sea or the Irish Sea. The South Tyne, East and West Allen rivers, and Devil's Water, in the north and north-east of the area, flow north into the Tyne Gap. Here they join the River Tyne, which flows eastwards to the North Sea. The River Wear rises near the centre of the area, and flows eastwards through the Durham Coalfield Pennine Fringe NCA and the Tyne and Wear Lowlands NCA. The Tees flows in a south-easterly direction, crossing the Tees Lowlands NCA to eventually flow into the North Sea at Teesside. Shorter tributaries flow west, down into the Eden, which eventually flows into the Irish Sea. The impervious rocks and high rainfall make this an important area for water capture, with rivers and reservoirs supplying clean water to conurbations and industries downstream. Land management practices here are also important in regulating water flow and water quality downstream – this is particularly significant for the River Eden, which is of international importance for its wildlife.

The extensive areas of semi-natural moorland and grassland habitats form important links between the adjoining uplands to the north and south, with their similar habitats. The few roads and settlements are contained within valleys, reinforcing the area's sense of remoteness and tranquillity.

The high, extensive fells of the North Pennines experience a severe climate but offer some of the most wild and remote landscapes to be experienced in England.

Key characteristics

- A distinctive upland landscape of upland plateaux divided by broad pastoral dales, each with its own distinctive character, most of it designated as an Area of Outstanding Natural Beauty (AONB).
- Strong landform of summits capped by Millstone Grit, with underlying alternating limestones, sandstones and shales of the Yoredale Series, creating stepped profiles to the dales.
- Igneous intrusions of dolerite forming Whin Sill, with striking crag outcrops and waterfalls. A dramatic scarp slope along the western edge, falling to the Eden valley.
- Much of the area is designated as a UNESCO European and Global Geopark for its many geological sites and features, including minerals.
- Remote and extensive moorlands of blanket bog, heathland and acidic grassland, managed for sheep and grouse. These moorlands support internationally important habitats, including arctic-alpine flora and populations of waders and raptors.
- A long tradition of livestock rearing combined with mining has created a landscape of enclosed pastures and meadows within the dales, with strong field patterns defined by drystone walls.
- Significant grassland habitats, including limestone grasslands, upland hay meadows, and calamarian grasslands on mining spoil, along with extensive acid grasslands.
- Area of high rainfall, with many fast-flowing streams and several major rivers flowing outwards from the hills, down the wide dales. These provide clean water and create a range of freshwater habitats.
- A very tranquil landscape, with a sense of remoteness. A low population, little light pollution, a slow rate of change, extensive open moorlands with panoramic views and a unique sense of wildness, all providing an inspirational recreational experience.
- The use of local sandstone and gritstone, with stone or slate for roofs, gives a strong vernacular character and unity to the villages, farmsteads and field barns.
- Tree cover is limited to river gorges, gills and stream sides, with copses around dispersed farmsteads. There are fragments of juniper scrub and some large conifer plantations on moorland fringes.
- A rich cultural history – from prehistoric settlements and defensive bastle houses to more recent industrial activity – with extensive evidence of early lead mining, extraction of other minerals and quarrying.

The North Pennines today

The North Pennines are characterised by some of the highest and wildest moorland summits in England, with the highest peaks of Mickle Fell, Knock Fell, Great Dun Fell and Cross Fell in the west reaching up to 893 m in altitude. These uplands are incised by relatively broad dales, creating a series of flat-topped ridges of open moorlands with panoramic views. A steep escarpment forms the western boundary, creating a striking backdrop to views from the Eden valley, while also providing dramatic views westwards to the Cumbria High Fells. The spectacular and evident geological interest of the area led to the North Pennines AONB being awarded the status of UNESCO European Geopark in 2003 and then Global Geopark in 2004.

Several major rivers, such as the South Tyne, East Allen, West Allen, Wear, Tees and tributaries of the Eden, rise in the upland block, flowing down the dales – both to the north and east – to the North Sea, and to the Irish Sea in the west. These clean, fast-flowing rivers support populations of otter, water vole, dipper, Atlantic salmon, brown trout and white-clawed crayfish. Where rivers cross the hard rocks of the Whin Sill they form dramatic waterfalls, such as at High Force, Low Force and Cauldron Snout. Erosion of limestone by water has, over time, created cave systems – some of which have been designated as Sites of Special Scientific Interest (SSSI) for their geological features, notably at Fairy Hole Caves and Knock Fell Caverns. The relatively high rainfall, combined with impervious rocks, makes the area very important as a water catchment. Several large reservoirs provide water for both domestic and industrial use to the conurbations of Carlisle, Tyneside, Wearside and Teesside.

These uplands are subject to a severe climate, with high rainfall, low temperatures and strong winds in both winter and summer. The extensive moorlands, with their lack of built structures, offer an experience of wildness and remoteness found in few other places in England.

Peaty soils cover extensive areas of the higher ground, and give rise to internationally important mosaics of moorland vegetation. Most of the higher land (46 per cent) is designated as a Special Protection Area (SPA) for its populations of hen harrier, merlin, peregrine, golden plover, curlew and dunlin. Other characteristic birds include red grouse and ring ouzel, with 80 per cent of England's black grouse found here. Montane heath can be found on the summits, along with prostrate shrubs, mosses and lichens. Wet

The North Pennines is an open and remote landscape with long views and big skies. There are extensive heather moorlands and acidic grasslands on the fells, managed for livestock rearing and grouse shooting, and of international significance for their habitats and bird populations.

heath, mires and blanket bog, dominated by heather, sphagnum and cotton grass, have developed elsewhere on the cool, wet plateau – especially along the west side. In the drier east there are mosaics of dry heath habitats, with heather and bilberry. The moorlands are managed for both sheep rearing and grouse shooting. Livestock also graze the extensive areas of acid grassland, and the allotments and rough grasslands on the hillsides. With their mosaics of wet and rushy pastures, these provide feeding, nesting and roosting areas for black grouse and upland waders such as lapwing, redshank and snipe.

Where limestone is close to the surface, as in the south-west of the area, there are species-rich calcareous grasslands with base-rich flushes. Some areas comprise important assemblages of arctic-alpine species, probably surviving from the glacial period. The 'sugar limestone' grasslands of Upper Teesdale are one of the most botanically rich areas in upland Britain. They boast their own internationally recognised 'Teesdale Assemblage', which includes Teesdale sandwort, Teesdale violet, alpine meadow rue, bird's eye primrose, spring gentian and alpine bartsia.

The broad dales, with their strong patterns formed by fields enclosed by drystone walls, and dispersed farmsteads and field barns built of local stone, contrast with the open uplands. Farm systems are based on sheep and cattle rearing on in-bye pastures and meadows in the valleys, supplemented with grazing rights on the commons (the moorlands).

The long tradition of livestock rearing has given rise to a range of species-rich pastures and meadows, and wet pastures, with over 40 per cent of the UK's upland hay meadows found here. Some of these hay meadows contain characteristic northern plants such as globeflower, wood crane's-bill, melancholy thistle and lady's mantle. The grasslands along the verges of minor roads and tracks, and alongside watercourses, are also often full of flowering plants, making them important assets for biodiversity as well as for the enjoyment of visitors.

The lower reaches of the dales are broader, with more hedges and field boundary trees. Woodlands are largely restricted to river banks and the steeper slopes of valleys and gills, in particular along the Tees, South Tyne, Derwent, West Allen and East Allen rivers, where some are of ancient origin. Upland ash woodlands occur on limestones, while fragments of upland oak woodlands survive on acidic soils on steep gill sides. With the high humidity and clean air, these woodlands have an abundance of bryophytes and lichens. Wet woodlands of alder, birch and willow are important winter food sources for black grouse, and occur in some valley bottoms. Stands of juniper scrub, of international significance, occur on the moorland fringes and on some gill sides, but tend to be fragmented; the exception is Upper Teesdale, where there are some extensive stands. On moorland fringes to the north and east, a number of large conifer plantations have been introduced; these support local populations of red squirrel and nightjar. The importance of the moorland, grassland, woodland and freshwater habitats in the North Pennines is reflected in the fact that 44 per cent of the area is designated as a Special Area of Conservation (SAC).

The population is low, with only a few small market towns, such as Alston, Stanhope, Wolsingham and Middleton-in-Teesdale. This lack of light sources results in dark night-time skies. Within the dales there are small villages, hamlets and farmsteads, with simple architectural detail, built of locally quarried sandstone, limestone or Millstone Grit, and with roofs of stone flag or slate. Settlements are also characterised by public buildings such as libraries, schools and non-conformist chapels. Isolated farms, often sheltered by a copse of trees,

are located along the moorland margins. There is a concentration of bastles (fortified farmsteads) towards the north, in Allendale and the South Tyne valley. A large proportion of the area is managed by a few estates, such as in Allendale and Teesdale, and the Ministry of Defence owns Appleby Fells. In Teesdale the whitewashed buildings of the Raby Estate are particularly distinctive, as is the picturesque estate village of Blanchland, near Derwent Reservoir.

The Northern Pennine Orefield became world-famous for its lead and other minerals, such as zinc and iron ores, copper, fluorspar, barytes and witherite. The landscape retains much evidence of this mining, such as mine buildings, smelt mills, shafts, levels, leats, washing floors and flues, while on the hillsides there are heaps of spoil and evidence of hushing (where water has been used to assist with the process of lead ore extraction). Over time, each dale has developed its own character, arising from combinations of landform, pastoral farming and industrial activity. Weardale, for example, retains more substantial evidence of this early industrial period than other dales.

In places, the presence of heavy metals in mining spoil, and in sands and gravels washed down into the rivers, has given rise to calamarian grasslands, with their specialised plant communities including alpine penny-cress, thrift, mountain pansy and spring sandwort.

Transport routes are limited, due the topography, with the main roads following the valley floors. However, much of the area (61 per cent) is open access land, and there are over 2,000 km of public rights of way, including three national trails (the Pennine Way, the Pennine Bridleway and a small stretch of the Hadrian's Wall Path). These, and the quiet roads, make the area a popular destination for walkers and, increasingly, for cyclists, with the popular C2C cycle route crossing the area. The many waterbodies – streams, rivers and reservoirs – provide opportunities for other recreational activities, such as canoeing and fishing.

The North Pennines are a very tranquil area, with a distinctive character that has inspired many writers, including Sir Walter Scott, Charles Dickens and W.H. Auden, and artists such as J.M.W. Turner, John Martin, Thomas Smith and George Lambert; the area continues to attract artists and writers today.

The North Pennines is an open and remote landscape, with extensive heather moorlands on the fell tops, rough pastures on lower slopes, and dispersed farms and a few small settlements in the valleys, as here in South Tynedale above Garrigill.

The landscape through time

The North Pennines is dominated by the effects of the Alston Block, which is bounded by faults. The most prominent of these is the North Pennine Fault System, marked by the dramatic escarpment along the west side of the area.

The older Ordovician and Silurian slates and volcanic rocks are exposed in Upper Teesdale and form distinctive conical hills (or 'pikes') along the foot of the Pennine escarpment. Intruded into these rocks, at depth, is the Weardale Granite. This relatively buoyant rock has ensured that the area has remained higher than the surrounding land. Carboniferous-age rocks, composed of layers of limestone, shale, sandstone and coal, overlay the granite and form most of the visible bedrock. This sequence forms most of the area's fells and dales. Differential erosion of these rocks has produced flat-topped hills and terraced profiles to many hillsides, sometimes with prominent limestone or sandstone scars.

Intruded into the Carboniferous rocks is the Whin Sill, a hard, columnar-jointed igneous rock that is resistant to erosion. This forms dramatic crags – such as at High Cup Nick, Holwick Scar and Cronkley Fell – and, where crossed by rivers, it forms spectacular waterfalls like High Force and Cauldron Snout. In Upper Teesdale, areas of limestone were metamorphosed by the hot intrusion to form a crumbly marble that weathers into sugar limestone, which supports internationally important arctic-alpine flora. A network of mineral veins formed underground from warm, mineral-rich solutions. These deposits have been mined for centuries for minerals such as galena (lead ore), sphalerite (zinc ore), and iron and copper ores. Frosterley Marble, a layer of dark grey limestone with fossil corals, is a highly prized building stone, used in important buildings throughout the area as well as in Durham Cathedral and further afield.

In the more recent geological past, the landscape has been shaped by ice and meltwater. During the last glacial period, a thick ice sheet widened the valleys and smoothed the hills, depositing clay, sand and boulders, and forming drumlins in valley bottoms.

The moorlands retain exceptionally well preserved field remains of prehistoric settlement, ritual sites and features, as well as sheilings (seasonal sites for summer sheep and cattle pastures). The dales also retain medieval and later features, such as settlement earthworks, lynchets and ridge-and-furrow, associated with the expansion and contraction of agriculture and settlement.

In the Roman period, the area was an important part of the military frontier zone, and several roads crossed the uplands. There is evidence of widespread small farms from this period, with cereal cultivation high up the dales. The tradition of building farmsteads in which the farming family lived above the farm animals, benefitting from the heat provided by them in this cool upland area, continued into the 18th century. Early settlements, with long rectangular fields and ridge-and-furrow, were concentrated in the sheltered valleys. The enclosed fields seen today can reveal two or more phases of enclosure, in that the present stone walls either respond to or cut across earlier bank or bank-and-ditch boundaries. In the north of the area, defensive bastles and pele towers (small, fortified keeps or tower houses) were built to protect from raids from the north, and many still remain – especially in Allendale and the South Tyne valley.

From the 12th century there were extensive royal hunting forests throughout the area, along with vaccaries (cattle ranches). The extraction of lead, silver, iron, zinc and copper ores took place from the 12th century onwards. Much of the current pattern of farms and fields was established from the 16th

century, when miner-farmers established smallholdings in which farmsteads were combined with barns and haylofts, and a few pastures and meadows in the valleys were defined by drystone walls, supported by grazing rights on the commons on the hilltops.

The mining and smelting of lead ore and precious metals left indelible marks on the landscape in the form of old spoil heaps, mine buildings, shafts, levels, leats, wheel pits, washing floors, flues, chimneys, hushes and open cast workings. The industry expanded with the introduction of the railway in the mid-19th century, and the population increased, reaching a peak of 27,000 in 1861, with mining activity focused around places like Kilhope, Alston, Nenthead and Rookhope. Planned villages, such as at Allenheads, were built for the workers. Subsequently, fluorite and barytes were also mined, but the decline of the mining industry from the late 19th century resulted in the significant depopulation of the area.

Large-scale quarrying has also left its mark, with several quarry sites in the Whin Sill outcrop in Teesdale, and the Great Limestone outcrop in Weardale. Only a few of these quarries are still active. In the 19th and 20th centuries the impervious rock and high rainfall led to the construction of several reservoirs, such as Derwent, Cow Green, Grassholme, Balderhead and Selset, to supply the industry and urban populations of Tyneside, Wearside and Teesside. Around this time, management for grouse shooting joined that for livestock grazing in influencing the extensive tracts of open heather moorland, with the introduction of stone butts and remote shooting huts.

During the 20th century several conifer plantations were established on the moorland fringes, while increases in livestock numbers and drainage led to an increase in grass moor and rough grazing – at the expense of heather moorland. Other changes in agricultural practices, such as increased fertiliser use, led to a reduction in species-rich hay meadows. There was an increase in recreational uses such as walking, fishing, sailing, canoeing, and grouse and pheasant shooting.

The area's distinctive landscape led to the designation of 88 per cent of it as an AONB in 1988. The AONB was then awarded UNESCO Global Geopark status in 2004, for its special geological interest.

Evidence of past mining is extensive, as here at Nenthead, with mining buildings in the valley and spoil from washings on the slope to the right. Calamarian grasslands develop on mining waste, with specialised plants, such as spring sandwort, that can survive the high levels of heavy metals.

Ecosystem services

The North Pennines NCA provides a wide range of benefits to society. Each is derived from the attributes and processes (both natural and cultural features) within the area. These benefits are known collectively as 'ecosystem services'. The predominant services are summarised below. Further information on ecosystem services provided in the North Pennines NCA is contained in the 'Analysis' section of this document (Supporting document 3).

Provisioning services (food, fibre and water supply)

- **Food provision**: Agriculture is limited by the climate, topography and soils, with 94 per cent of the land classified as grade 4 or 5. However, the area is important for rearing hardy hill livestock, with high numbers of sheep and cattle.

- **Timber provision:** Timber is produced from 6,663 ha of coniferous plantations, while the production of wood fuel could be increased by bringing more of the small, broadleaved woodlands and plantations under management.

- **Water availability:** With its high rainfall and impervious rocks, this upland block is an important catchment for the Tyne, Wear and Tees, and has several large reservoirs, such as Derwent, Cow Green, Grassholme, Balderhead and Selset. The area provides water for both domestic and industrial use downstream in Tyneside, Wearside, Teesside and Carlisle.

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

- **Climate regulation:** Peaty soils with a high carbon content cover 62 per cent of the area, and underlie blanket bog, upland heath and mires, while humus-rich soils cover a further 5 per cent. Appropriate management of the moorlands, including encouraging active peat formation and re-vegetating bare peat, can improve carbon capture, as can extending woodland cover. Low-input extensive livestock systems can reduce the amount of artificial fertiliser used, while increasing the organic content of the soils.

- **Regulating soil erosion:** The extensive peaty soils are prone to wind and water erosion. Sediment run-off can be reduced by ensuring good vegetative cover on blanket bog and heather moorland. In the dales, maintaining a good protective cover of vegetation, such as permanent grassland, scrub or woodland – particularly on steep gill sides and alongside watercourses – will protect soils from erosion and reduce sediment run-off.

- **Regulating water quality:** Water quality is predominantly good in the many fast-flowing streams and rivers, but there are some issues of diffuse pollution and point-source pollution from mining spoil and river gravels. There is also some localised discolouration of water from eroded peat with poor vegetation cover, which can be addressed by appropriate moorland management.

- **Regulating water flow:** The greatest risks from river flooding are downstream, in urban locations in Tyneside, Wearside and Teesside, and also in Carlisle. Improving land management practices, taking steps to reduce run-off from the land and slow the flow of floodwaters – for example by restoring vegetation cover on peat, creating woodlands and expanding wetlands and flood storage areas in the dales – will benefit the many settlements downstream.

Cultural services (inspiration, education and wellbeing)

- **Sense of place/inspiration**: The North Pennines provide one of the most remote and wild experiences in England, the expansive open moorlands contrasting with the more sheltered dales, with their meadows, pastures and drystone walls, villages and dispersed farmsteads all built in local stone. This distinctive landscape has a strong sense of place and cultural continuity, based on its long history of farming and mining. There are cultural associations with many writers and artists, including W.H. Auden and J.M.W. Turner. The protection and enhancement of the area's special qualities is of primary importance, as 88 per cent of the area is designated as an AONB.

- **Sense of history**: This is portrayed in the rich time depth of historic heritage, from bronze-age field systems to the subsistence miner-farmer landscape, with its wealth of evidence of mining activities. In particular, the area has great potential for revealing evidence of historic land uses, especially on the moorland, due to the lack of cultivation and development. Historic features, and those areas with a high integrity of features related to these, should be protected and interpreted to reveal the continuity and connections between the geology, the history of man's activities and today's landscape.

- **Tranquillity:** The North Pennines have high levels of tranquillity, with their low population, few villages and roads, a lack of development, open moorlands and quiet dales. Development and light sources need to be controlled to maintain the tranquillity and dark night-time skies.

- **Recreation:** There are extensive areas of open access land on the moorlands, covering 61 per cent of the area. There is also a good network of rights of way, with three national trails and forests that provide a range of recreational opportunities. In addition to walking, there are a range of sites available for informal countryside recreation such as cycling, fishing, canoeing, wildlife watching, caving, grouse shooting, eco- and geotourism and heritage tourism.

- **Biodiversity:** The North Pennines are internationally recognised as very important for arctic-alpine flora, upland moorland habitats, limestone grasslands, hay meadows, woodlands, becks and rivers, with their associated species. Some 46 per cent of the area is designated as an SPA, for its biodiversity value. The range of habitats supports some iconic birds as curlews, black grouse, ring ouzel and several raptors, which are a key attraction to visitors.

- **Geodiversity:** With its dramatic landforms, intrusions of hard Whin Sill rock and long history of mineral exploitation, the North Pennines NCA is internationally important for its geodiversity, and has been awarded UNESCO European and Global Geopark status.

Statements of Environmental Opportunity

SEO 1: Protect, manage and enhance the moorlands and moorland fringes of the North Pennines, with their internationally important habitats and wildlife, their sense of wildness and remoteness, and the contribution they make to climate mitigation, water quality and availability, and water flow.

For example, by:

- Ensuring that moorland habitats (including blanket bog, mires and heath with mosaics of heather, cotton grass and bilberry) are under sustainable management and responsive grazing regimes, to maintain and enhance their biodiversity interest, maintain the condition of water and soils, and aid water infiltration, while continuing to support livestock farming and grouse shooting.
- Restoring vegetation cover on degraded and eroded areas of peat, through measures such as grip blocking and controlled grazing.
- Managing the extensive areas of blanket bog to bring them into favourable hydrological and ecological condition, so that they actively develop and improve their capacity to store carbon and hold water. This will help with managing water flow, and improving water quality and biodiversity.
- Managing rough grazing and pastures adjacent to the moorlands, through rush cutting and cattle grazing where appropriate, to create a patchwork of grasslands that provide diverse feeding, roosting and breeding conditions. This will support and increase the populations of upland waders such as curlew, redshank, golden plover, lapwing and black grouse.
- Ensuring that the calcareous grasslands, which support a rare and diverse flora, are managed in such a way that the plant communities are protected and enhanced. This includes the unique sugar limestone grasslands of Upper Teesdale, which are particularly important for their arctic-alpine flora.
- Maintaining the tranquillity, lack of disturbance and dark night skies of the expansive open moorlands, by discouraging the introduction of tracks, built forms and light pollution. These would impact on the visual quality of the moorlands, and reduce the strong sense of place, wildness and remoteness.

SEO 2: Protect, manage and conserve the distinctive historic and geological environment and features of this area, providing access and recreation along with imaginative interpretation, to improve understanding of the landscape and its cultural development.

For example, by:

- Identifying and protecting the special geological features of the area, both within and outside designated areas, and seeking opportunities to provide access with imaginative interpretation.
- Seeking opportunities to keep important geological exposures (such as quarry faces, cuttings, outcrops and stream sections) visible, so that the underlying geology can be understood and access can be provided, increasing people's enjoyment and learning.
- Implementing the Local Geodiversity Action Plan and ensuring that the area is exemplary as a UNESCO European and Global Geopark.
- Identifying stretches of landscape where there is a high incidence of related historic features, and working to conserve and manage them, providing innovative interpretation to improve understanding of the landscape and of the inter-relationships between geology, history, and past and present land uses.
- Conserving and interpreting features such as archaeological earthworks and sub-surface archaeology.
- Recognising the exceptionally high potential in this area for identifying further archaeological evidence of medieval and earlier land use and settlement, and encouraging further fieldwork to reveal undiscovered remains.
- Researching and recording archaeological evidence, historic buildings and other heritage features, and providing imaginative interpretation where appropriate, linking them to their historic landscapes, and engaging a wide range of people in these activities.
- Encouraging sustainable ecotourism that is based on an appreciation of the special qualities of the natural environment, avoiding activities that will have an adverse impact on them. Using innovative interpretation that will engage the public in better understanding the connections between past land uses and today's landscape.
- Encouraging access and quiet recreation, but managing these activities to maintain the sense of remoteness and the tranquillity, and avoiding any adverse impacts on wildlife or historic features.
- Protecting historic features from the effects of weathering and decay, and making a record of them where this is not possible.
- Preserving archaeological ground features – in particular from the effects of poaching by livestock – by managing grazing levels.
- Maintaining traditional farmsteads and vernacular buildings, and their contribution to the landscape and sense of place, by promoting and encouraging the use of locally sourced materials, and encouraging the improvement of skills in walling, building repair and maintenance.
- Encouraging the repair, restoration and appropriate conversion of traditional farmsteads and vernacular buildings in the villages and hamlets, using local stone and building styles. This will ensure their historic integrity, long-term survival and contribution to the North Pennines landscape and strong sense of place.

Continued on next page

SEO 2 continued

- Raising awareness of the strong cultural identity of the area, and engaging local communities in capturing and promoting the connections between themselves and their landscape.
- Creating new and improved access via links with public rights of way near towns and villages, providing valuable circular routes. In particular, linking with key routes such as the Pennine Way, South Tyne Trail, Weardale Way and Teesdale Way.
- Ensuring that paths are well maintained, improved and signposted, providing routes that are accessible to all at key locations (such as reservoirs). Avoiding inappropriate development in remote areas, or through areas with vulnerable plant or animal communities, or historical or geological interest.

SEO 3: Manage and enhance the pastoral character of the broad dales, with their patchworks of pastures and meadows, their strong field patterns defined by drystone walls, and their stone-built field barns, farmsteads and small villages – to strengthen local distinctiveness, and to contribute to food provision, climate change mitigation, the conservation and connectivity of important habitats and the sense of history.

For example, by:

- Seeking ways of ensuring the continued viability of upland farming, through agri-environment schemes and other sources of funding, recognising the high nature-value farming that is practised in the area.
- Working with farmers to link food production (achieved through environmentally sensitive land management) with the special and distinctive qualities of the area, thus promoting the strong cultural identity of the North Pennines through local branding.
- Encouraging the management of meadows for hay, with no inputs of artificial fertilisers, as part of extensive livestock grazing regimes. This will help to maintain and enhance a wide range of flowering plants and other hay meadow species, enhancing their contribution to climate change mitigation and water infiltration.
- Seeking opportunities to restore and expand species-rich hay meadows, adopting carefully managed grazing and cutting regimes, and continuing with research and development into ways of seeding with green hay.
- Working with farmers to achieve sustainable and extensive grazing regimes on permanent pastures and meadows, reducing poaching and inputs of fertilisers and other chemicals, thus contributing to climate change mitigation and biodiversity interest, and improving pollination services, water quality and soil quality.
- Encouraging the management of the pastoral landscape of pastures and meadows, to create a patchwork of grasslands with varying hydrology

Continued on next page

SEO 3 continued

and intensity of management. This will help to support and increase populations of breeding waders and other birds, and will provide visual and species diversity.

- Encouraging the adoption of incentive schemes to increase the use of environmentally sensitive land management. This will help to reduce the risk to ground features and historic sites, while also contributing to food provision, protecting soil and water quality, and improving landscape and biodiversity interest.
- Managing roadside and track verges, other linear features and small sites within villages, to create improved networks of semi-natural habitats and pollination sources, enabling species movement as well as enhancing the experience for visitors.
- Conserving the distinctive and cohesive settlement patterns of the dales, with their vernacular character of dispersed farmsteads and hamlets, and small villages with public buildings. Promoting the use of the AONB building design guidance[4].
- Using local building materials and styles in the restoration of vernacular architecture.
- Ensuring that any new development retains its links with the underlying geology and does not detract from the sense of history.
- Using local stone for restoring and maintaining the strong field patterns of drystone walls with dispersed field barns and farmsteads, retaining them as key historic features so that visual unity is retained and the relationship with the underlying geology is strengthened.
- Promoting opportunities to increase the public's understanding, interpretation and enjoyment of the distinctive pastoral landscape of the dales, their history and their contribution to food provision, biodiversity, climate change mitigation and the landscape.

This view of a characteristic historic landscape near Eastgate in Weardale shows 18th century drystone walls cutting across a Romano-British track, with evidence of prehistoric field patterns and local small-scale quarrying. The 20th century cement works on the skyline have now been removed.

[4] www.eden.gov.uk/planning-and-development/eden-local-development-framework/supplementary-planning-documents/north-pennines-area-of-outstanding-beauty-aonb-building-design-guide-spd/

SEO 4: Manage the diverse streams, becks, rivers and reservoirs to maintain their high water quality, enhance their biodiversity interest, and strengthen their contribution to the landscape character and recreational opportunities of the North Pennines, while managing water flows and maintaining water supplies.

For example, by:

- Encouraging the restoration and management of natural hydrological conditions to wetland systems (including blanket bogs, river flood plains, mires and wet grasslands) on the moorlands and within the dales.
- Seeking opportunities to allow rivers and streams to follow their natural courses, with extended flood storage areas to increase water holding capacity and water infiltration, and to moderate flows.
- Seeking opportunities to expand areas of wetland (including reedbeds, wet pastures and wet woodlands) in temporary flood storage areas.
- Managing watercourses to retain a range of natural conditions to maintain and increase fish, water vole and invertebrate populations, while also ensuring that suitable locations are provided for recreational activities such as fishing, canoeing and wildlife watching.
- Identifying and managing the calamarian grasslands, to protect and enhance their very specific plant communities. Linking the grasslands to the interpretation of the area's mining and cultural heritage, to improve understanding and appreciation of their significance.
- Seeking solutions to improve water quality, such as the creation of reedbeds to reduce pollution from former mines and mining spoil.
- Removing artificial obstacles on rivers that prevent the passage of migratory salmonids, to improve recreational angling and enhance biodiversity interest.
- Ensuring that on-farm water storage is designed to enhance the local landscape and biodiversity interest, through careful site selection, encouraging emergent vegetation and maintaining clean, oxygenated water.
- Promoting the establishment of riparian vegetation along rivers and streams, in particular by excluding livestock, encouraging the natural regeneration and/or planting of native trees and scrub (and emergent vegetation cover), along with permanent grassland. This will prevent erosion and sedimentation, while also improving habitats for species such as otters and water voles, and providing shade for fish.
- Working collaboratively to control the spread of invasive species along river corridors, in particular Himalayan balsam, Japanese knotweed and giant hogweed, to maintain the biodiversity value of the watercourses.

Additional opportunity

1. Protect and restore ancient and important woodlands, manage existing woodlands and plantations, and expand the area of broadleaved woodland, to enhance the landscape and biodiversity value, provide timber and wood fuel, and contribute further to climate change mitigation, water and soil quality, and managing water flow.

For example, by:

- Bringing existing semi-natural woodlands into management that ensures their long-term survival and productivity. Excluding livestock to encourage the natural regeneration of trees and shrubs, to increase carbon capture, soil protection and enhance biodiversity interest, while ensuring the long-term survival of trees as features in the landscape.
- Protecting and restoring the significant areas of ancient woodland, and restoring native trees, shrubs and ground flora in plantations that have been established on ancient woodland sites.
- Expanding the area of upland ash and oak woodlands in gills, on valley sides and on moorland fringes, and wet alder woodlands on valley bottoms. This will strengthen the contribution that woodlands make to the landscape and to biodiversity, along with improving carbon storage, reducing soil erosion and water flow, forming links between habitats, and making existing woodlands more resilient to climate change and tree diseases, while avoiding damage to significant archaeological sites.
- Finding opportunities to create open woodlands, wood pasture and scrub (using native broadleaved species) in gills and on the moorland fringes, in particular to support the black grouse population.
- Encouraging further restructuring of conifer forests, taking opportunities to improve the outline and shape of plantations so that they respond better to the local landform and are less obtrusive in the landscape. Improving the range of habitats by increasing open spaces and the proportion of native broadleaved species.
- Seeking opportunities to restore open land, focusing on designated sites and on areas where long-term restoration can be achieved that will lead to clear landscape and biodiversity benefits. Seeking compensatory planting in more appropriate locations, to maintain the extent of woodland cover.
- Protecting juniper scrub with fencing to prevent uncontrolled grazing and manage low levels of cattle grazing, to encourage natural regeneration. Considering supplementary planting of local provenance to expand the area of scrub, and to make it more robust and resilient to climate change.
- Promoting measures that adhere to the developing guidance on controlling the spread of Phytophthora austrocedrae, for example cutting out and burning infected juniper, and applying biosecurity measures to reduce transmission of the disease. This will help to maintain the biodiversity value and contribution made by the stands of juniper to the local landscape.
- Identifying the occurrence of ash dieback and potentially resistant trees, working collaboratively to control the spread of the disease and managing woodlands to improve their resilience to it.
- Encouraging access to and quiet recreational uses of forests and woodlands and extending access into new areas where appropriate.

Supporting document 1: Key facts and data

North Pennines National Character Area (NCA): 214,563 ha

1. Landscape and nature conservation designations

188,488 ha, or 88 per cent, of the NCA lies within the North Pennines Area of Outstanding Natural Beauty (AONB). Less than 1 per cent (46 ha) lies within the Yorkshire Dales National Park.

Management Plans for the protected landscape can be found at:

- www.northpennines.org.uk/
- www.yorkshiredales.org.uk/

Source: Natural England (2011)

1.1 Designated nature conservation sites

The NCA includes the following statutory nature conservation designations:

Tier	Designation	Site(s)	Area (ha)	% of NCA
International	n/a	n/a	0	0
European	Special Protection Area (SPA)	North Pennine Moors SPA	98,413	46
	Special Area of Conservation (SAC)	North Pennine Moors SAC; Moor House – Upper Teesdale SAC; North Pennine Dales Meadows SAC; Helbeck and Swindale Woods SAC; Tyne and Nent SAC; River Eden SAC; Tyne & Allen River Gravels SAC	93,579	44
National	National Nature Reserve (NNR)	Moor House – Upper Teesdale NNR, Derwent Gorge and Muggleswick Woods NNR	8,670	4
National	Site of Special Scientific Interest (SSSI)	A total of 86 sites wholly or partly within the NCA	100,845	47

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 of international designations is 98,773 ha (46 per cent of the NCA). National designations cover 100,845 ha (47 per cent). The European designations overlap with the majority of the SSSI.

There are 131 local sites of nature conservation interest in the North Pennines NCA covering 12,727 ha which is 6 per cent of the NCA.

Source: Natural England (2011)

- Details of individual Sites of Special Scientific Interest can be searched at: http://www.sssi.naturalengland.org.uk/Special/sssi/search.cfm
- Details of Local Nature Reserves (LNR) can be searched at: http://www.lnr.naturalengland.org.uk/Special/lnr/lnr_search.asp
- Maps showing locations of Statutory sites can be found at: http://magic.defra.gov.uk/website/magic/ – select 'Rural Designations Statutory'

1.1.1 Condition of designated sites

Condition category	Area (ha)	% of SSSI land in category condition
Unfavourable declining	1,071	1
Favourable	12,026	12
Unfavourable no change	7,975	8
Unfavourable recovering	79,552	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

Elevation ranges from 45 metres above sea level at to a maximum of 891 metres at Cross Fell, one of a number of massive moorland summits on the broad ridge on the western edge of the NCA. The average elevation of the landscape is 404 metres above sea level.

Source: Natural England (2010)

2.2 Landform and process

An upland landscape of high moorland ridges divided by broad pastoral dales – the high summit ridge of Cross Fell (891m) in the west falling in a dramatic escarpment to the Eden Valley. Long, relatively low sandstone and limestone scars are prominent features in many places.

Source: North Pennines Countryside Character Area Description

2.3 Bedrock geology

The geology of the North Pennines is defined by the Alston Block, a structural unit consisting of a succession of Carboniferous sedimentary rocks dipping gently eastwards towards the North Sea. It is bounded to the north by the Stublick Fault System along the Tyne Gap, on the west by the Pennine Fault System along the Pennine escarpment, and on the south by the Lunedale Fault System. On its eastern margin the area adjoins the Durham Coalfield.

Older, mainly Ordovician age, mudstones and volcanic rocks which underlie the Carboniferous rocks crop out along the foot of the Pennine escarpment and in a small inlier in Upper Teesdale.

Carboniferous rocks mainly comprise the Yoredale Series, a succession of limestones, sandstones and shales with a few very thin coals, which produce distinctive terraced features on many hillsides.

Many hilltops coincide with the outcrop of sandstone beds giving them characteristic flat tops.

A large horizontal body of igneous rock known as Whin Sill is intruded into the Carboniferous rocks. The dolerite of the Whin Sill outcrops along the Pennine escarpment and in Teesdale, such as at Holwick Scars, Cronkley Fell, and High Cup Nick, which are marked by striking dark, columnar-jointed crags.

Intrusion of the hot magma that formed Whin Sill altered the composition of the adjacent rocks. Locally in Upper Teesdale, wide areas of limestone were baked to form a coarse-grained marble, in its weathered form known as 'sugar limestone', which supports an internationally important relic alpine flora.

Numerous mineral veins which carry ores of lead, zinc and, in a few places, copper, many of which have been mined in the past. Associated with the metal ores are minerals such as fluorite, barytes, and witherite. Numerous marks left on the landscape of former mineral working including hushes, spoil heaps and quarries.

Source: British Geological Survey (2006)

2.4 Superficial deposits

Glacial deposits mantle some of the valley slopes and hilltops partially obscuring the Carboniferous rocks. Peat blanket bog covers extensive areas of the higher ground on the internationally important Moorhouse National Nature Reserve.

Source: British Geological Survey (2006)

2.5 Designated geological sites

Designation	Number
Geological Site of Special Scientific Interest (SSSI)	18
Mixed interest SSSIs	6

These sites are mainly associated with former mines, disused quarries and river sections. There are 13 Local Geological Sites within the NCA, many of them of rock outcrops. The area was designated a UNESCO European Geopark in 2003, and a Global Geopark in 2004, for its outstanding geological features.

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 9 main soilscape types; blanket bog peat soils, covering 34 per cent of the NCA; slowly permeable wet very acid upland soils with a peaty surface (25 per cent); slowly permeable seasonally wet acid loamy and clayey soils (25 per cent); freely draining slightly acid loamy soils (4 per cent); freely draining very acid sandy and loamy soils (3 per cent); very acid loamy upland soils with a wet peaty surface (3 per cent); slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (2 per cent); freely draining acid loamy soils over rock (1 per cent); and raised bog peat soils(1 per cent).

Much of this NCA, 67 per cent, contains soils with a high carbon content (20 to 50 per cent), including the deep blanket bog peat soils, the slowly permeable wet very acid upland soils with a peaty surface, and the very acid sandy soils that may have organic and peaty topsoils.

On higher ground the rock is covered by a thick layer of peat which, in turn, rests upon glacial clay. In the higher, wetter, western areas this appears as blanket bog, while in the lower and drier east it supports heather moorland or acidic grassland. Where the limestone breaks through, in extensive scars or along deeply incised river valleys, richer soils have developed, supporting a varied lime-loving vegetation; in the far west of the area, above Brough, the limestone outcrops as pavement.

A particularly significant geological feature of Upper Teesdale, towards the southern part of the area, is an intrusion of the igneous Whin Sill into the limestone, the result of which was the baking of the limestone into a type of marble. This has itself become weathered into the so-called “sugar limestone” soil which supports the unique Teesdale flora.

Another offshoot of the geology of the area has resulted in an interesting flora associated with river alluvium in the South Tyne system. The Alston Block lies within the North Pennine Orefield, from which lead, zinc, cadmium and copper were produced in the past. These mining activities have resulted in soils contaminated with these ‘heavy metals’; where they occur along the South Tyne and the East and West Allens, they support populations of heavy metal resistant flora (‘metallophytes’). Areas of spoil in the vicinity of mines also support elements of this flora.

Source: North Pennines Natural Area Profile, National Soils Resources Institute Soilscape Maps.

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	7,347	3
Grade 4	38,598	18
Grade 5	162,010	76
Non-agricultural	6,607	3
Urban	1	<1

Source: Natural England (2010)

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

Kilhope Mine, with its restored structures and interpretation of the lead mining industry, and now sheltered by a 20th century plantation, is a popular heritage centre for visitors.

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 in NCA (km)
River Tees	40
River Wear	33
River South Tyne	33
Devils Water	21
River East Allen	21
River West Allen	18
River Derwent	15
Black Burn	12
River Greta	12
Croglin Water	10
Harwood Beck	10
River Lune	8
River Gelt	7
River Allen	5
Crowdundle Beck	4
River Gaunless	3

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.

A number of main rivers and their tributaries have their headwaters in the NCA. Most drain north or eastwards from the area. Some short tributaries feed into the River Eden to the west of the NCA. In addition a number of reservoirs are scattered throughout the dales and moorland margins. Reservoirs within the NCA include Cow Green, Baldershead, Selset, Derwent, Burnhope, Smiddy Shaw, Waskerley, Hury and Grassholme.

3.2 Water quality

The total area of Nitrate Vulnerable Zone is 7,608 ha, or 4 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 at: **http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e**

Fast flowing rivers are important features of the landscape, as here in Upper Weardale - a narrow valley, with broadleaved woodland surviving on the steeper slopes and conifer plantations planted on the hillside, below the moorlands on the fell tops. Scattered whitewashed farms, barns and drystone walls are typical features.

4. Trees and woodlands

4.1 Total woodland cover

The NCA contains 12,026 ha of woodlands over 2 ha, 5.6 per cent of the total area, of which 1,912 ha, less than 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

Tree cover is generally sparse. In places there are extensive coniferous plantations on the moorland ridges. Semi-natural woodland is largely restricted to river banks, watercourses and minor valleys and gills mainly of the Tees, South Tyne, Allens, Devil's Water and Derwent in the middle / upper reaches of the dales. Ash and alder-ash woodlands are found on the limestones, and oak / birch woodlands on acidic soils. Hedgerow trees are abundant and the lower dales landscape is well wooded with semi-natural woodlands in ravines, gorges, scattered farm woodlands, shelter belts and coniferous plantations. Wet woodland occurs on poorly drained or seasonally waterlogged soils, often along streams and flushes, in peaty hollows, and as successional habitat on fens and bogs.

Source: North Pennines Natural Area Profile

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	3,172	1
Coniferous	6,663	3
Mixed	364	<1
Other	1,827	1

Source: Forestry Commission (2011)

Area & proportion of Ancient Woodland & Planted Ancient Woodland within the NCA:

Type	Area (ha)	% of NCA
Ancient semi-natural woodland	1,074	<1
Ancient re-planted woodland (PAWS)	833	<1

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

Arable fields and pastures of the lower dales, generally enclosed by 1750, are regular, relatively broad and divided by hedgerows and drystone walls. Hedgerow trees are abundant. The middles and upper reaches are more pastoral in character with semi-improved and unimproved pastures and hay meadows bounded by drystone walls.

Source: North Pennines Countryside Character Area description; Countryside Quality Counts (2003)

5.2 Field patterns

Middle and upper dales, mostly subject to enclosure from the 17th century, maintain long-standing divisions of in-bye and out-bye leading out to extensive grazing rights on the adjoining moorland. Heads of dales contain distinctive, patterned small enclosures, some reflecting 16th to 18th century 'miner-farmer' smallholdings: Upper Weardale, Teesdale, Allendale and South Tyne Valley. Moorland summits and plateau were used as common grazing pasture, with extensive enclosure in the late 18th to mid 19th century, but 27 per cent remains common land.

Source: North Pennines 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

The farming character of this landscape is shown in the breakdown of main farm types (2009) with 659 grazing livestock holdings in Less Favoured Areas (75 per cent), 21 mixed farms (2 per cent) and 23 dairy holdings (3 per cent). Farms classified as other are also numerous accounting for 150 holdings (17 per cent). Census data from 2000 to 2009 shows a decrease of 30 dairy farms (55 per cent) within the NCA and a decrease from 55 lowland grazing livestock holdings to less than 5. However, there has been an 11 per cent increase in the number of farms classed as 'other'.

Source: Agricultural Census, Defra (2010)

6.2 Farm size

In 2000 there were 933 holdings in this NCA, and by the end of 2009 there were 882 holdings. Farms of over 100 hectares in size are the most numerous accounting for 303 holdings or 34 per cent, followed by 171 farms of 50 to 100 hectares in size accounting for 19 per cent of the total number of holdings. Between 2000 and 2009 the main trends were a decrease in the number of holdings of 5 to 20 hectares in size, from 190 to 160 holdings.

Source: Agricultural Census, Defra (2010)

6.3 Farm ownership

In 2009 43 per cent of the total farmed area was owner occupied, accounting for 1,353 holders. There had been an 8 per cent decrease in the area of owned land over the 2000 to 2009 period, and an 11 per cent

decrease in the number of holders.

2009: Total farm area = 122,731 ha; owned land = 52,625 ha
2000: Total farm area = 120,767 ha; owned land = 57,421 ha

Source: Agricultural Census, Defra (2010)

6.4 Land use

The dominant land use is grass and uncropped land accounting for 119,137 hectares (97 per cent). This is followed by cereals, 1,194 hectares or 1 per cent. Between 2000 and 2009 there was an increase in the area of grass and uncropped land by 2,132 hectares.

Source: Agricultural Census, Defra (2010)

6.5 Livestock numbers

Sheep remain the most numerous livestock in the North Pennines, although numbers decreased by around 22 per cent (658,449 to 516,500) between 2000 and 2009. The number of cattle also decreased from 54,300 to 41,300 (24 per cent) during this time.

Source: Agricultural Census, Defra (2010)

6.6 Farm labour

Trends from 2000 to 2009 show a decrease in the number of principal farmers from 1,526 to 1,353, an increase in the number of salaried managers from 16 to 23, and a decrease in full time workers, part time workers and casual/gang workers.

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 higher moorland summits and plateau in the west are dominated by blanket bog of heather, sphagnum and cotton grass and the drier ridges of the east are covered with heather and grass moorland. Where grazing pressure has been high the heather has been replaced by 'white moor' of acidic grassland and in places by bracken.

One of the most important habitats is limestone grassland, which contains a high diversity of plants including an unusual number of rare species. The sugar limestone grasslands of Upper Teesdale are particularly important because they include arctic-alpine / alpine flora. The area is also important for the presence of juniper scrub.

The species rich hay meadows of the North Pennines contain a large number of rare and local species. These hay meadows include some typical woodland flora and are thought to be remnants of historical woodland found in the area. Forty per cent of the UK's upland hay meadows can be found in the North Pennines. Calamarian grasslands, open or sparse turf that occurs on weathered mineral debris with high levels of heavy metals present, occur on spoil or river gravels where pollution from mining has occurred.

Semi-natural woodlands are found typically in minor valleys and ghylls, and along watercourses. Ash and alder-ash woodland can be found on limestone and oak-birch woodlands on acidic soils. Many are grazed by livestock and are in decline.

Source: North Pennines Natural Area Profile

7.2 Biodiversity Action Plan (BAP) priority habitats

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

UK BAP priority habitat	Area (ha)	% of NCA
Blanket bog	64,685	27
Upland heathland	34,345	14
Broadleaved mixed and yew woodland (broad habitat)	2,587	1
Upland calcareous grassland	1,637	<1
Reedbeds[1]	1,091	<1
Upland hay meadows	276	<1
Fens	217	<1
Lowland dry acid grassland	131	<1
Lowland meadows	97	<1
Lowland calcareous grassland	51	<1
Purple moor-grass and rush pasture	22	<1

Source: Natural England (2011)

[1]Reedbed figure is known to be an over-estimate due to the method of digitisation

Maps showing locations of UK BAP priority habitats are available at

- **http://magic.defra.gov.uk/website/magic/** select 'Habitat Inventories'

7.3 Key species and assemblages of species

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

Road and track verges often support a range of wild flowers, such as these globeflowers on the side of a track in Langdon Beck.

8. Settlement and development patterns

8.1 Settlement pattern

Small villages, hamlets and clusters of small farms, built of millstone grit or Carboniferous sandstone and with roofs of stone flag, are dispersed along the dale floors, their locations linked to the early development of mining. Isolated farms are located along the moorland margins. Pele towers, bastles (fortified farmsteads) and large farmhouses are located in defensive positions within the valleys, with a particularly high concentration of bastles occurring in Allendale and the South Tyne Valley.

Source: North Pennines Countryside Character Area description; Countryside Quality Counts (2003)

8.2 Main settlements

The main settlements are: Allendale, Wolsingham, Stanhope, Middleton-in-Teesdale and Alston. The total estimated population for this NCA (derived from ONS 2001 census data) is: 13,978.

Source: North Pennines Countryside Character Area description; Countryside Quality Counts (2003), Natural England (2012)

8.3 Local vernacular and building materials

A high proportion of the buildings in the area are characterised by simple architectural detailing and the use of local sandstone which provides a high degree of visual unity and reveals a close connection with the underlying land. Roofs are traditionally of stone slate, although Welsh or Cumbrian slate is common on later buildings. Many villages contain more modern housing, often constructed of brick. The settlement characteristics of the dales are strongly influenced by land tenure. A large proportion of the area is managed by estates and the whitewashed buildings of the Raby estate in Teesdale are particularly distinctive.

Source: North Pennines Countryside Character Area description; Countryside Quality Counts (2003)

This abandoned byrehouse, near Westgate in Weardale, is typical of the vernacular architecture that arose from the 18th century miner / farmer landscape, with the family living on the first floor, above the livestock.

9. Key historic sites and features

9.1 Origin of historic features

Mesolithic hunters may have begun the process of woodland clearance, and Neolithic farmer-hunters and Bronze Age settlers extended the process which, combined with climate change, led to development of the moors and peat bogs.

Bronze Age to Romano-British burial mounds and field systems, now on moorland, are visible reminders of the intensity of settlement in the late prehistoric period with examples at Barningham Moor, Hope Moor, Bowes Moor and Cotherstone Moor.

Transhumance activities within the wooded frontier zone of the Roman Empire led to the development of tracks and droves – a mixture of cattle rearing and cereal production that was still practiced in the medieval period. The Romans mined lead at Brough. A number of temporary camps, signal stations and settlements can be found in the landscape.

More extensive lead mines were opened from the medieval period onwards, drawing settlement from the valley floors to the higher orefields and reaching a peak in the mid 19th century. Purpose built villages, for example Allenheads, Nenthead and Middleton-in-Teesdale, emerged, importing the terraced housing patterns of the industrial townscapes, along with a wide variety of 'squatter' settlements complete with small agricultural plots.

Upper Weardale, Teesdale, Allendale and South Tyne Valley were populated with vaccaries (cattle ranches) in 12th and 13th centuries, many later examples of these and also medieval parks becoming subdivided as farms and hamlets from 15th century. There was a further increase in farming from the 17th century, connected to the lead industry.

The remains of lead (and silver) mining and processing are extensive, reflecting centuries of seasonal and concerted year-round industrial activity. These include spoil heaps, shafts and adits as well as mine buildings, washing floors, levels, wheel houses and dramatic scars left by hushing.

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

9.2 Designated historic assets

This NCA has the following historic designations:

- 0 Registered Parks and Gardens
- 0 Registered Battlefields
- 214 Scheduled Monuments
- 1,270 Listed Buildings

Two World Heritage Sites fall partly within the North Pennines NCA. Hadrian's Wall covers 57 ha (<1 per cent) and the Hadrian's Wall Buffer Zone covers 1,570 ha (1 per cent).

Source: Natural England (2010)

- More information is available at the following address: www.english-heritage.org.uk/caring/heritage-at-risk/
- www.english-heritage.org.uk/professional/protection/process/national-heritage-list-for-england/

10. Recreation and access

10.1 Public access

- Sixty-one per cent of the NCA, 130,979 ha, is classified as being publically accessible.
- There are 2,182 km of public rights of way at a density of 1 km per km^2.
- There are 3 National Trails within the North Pennines NCA: the Hadrian's Wall Path (2 km), the Pennine Bridleway (52 km) and the Pennine Way (129 km).

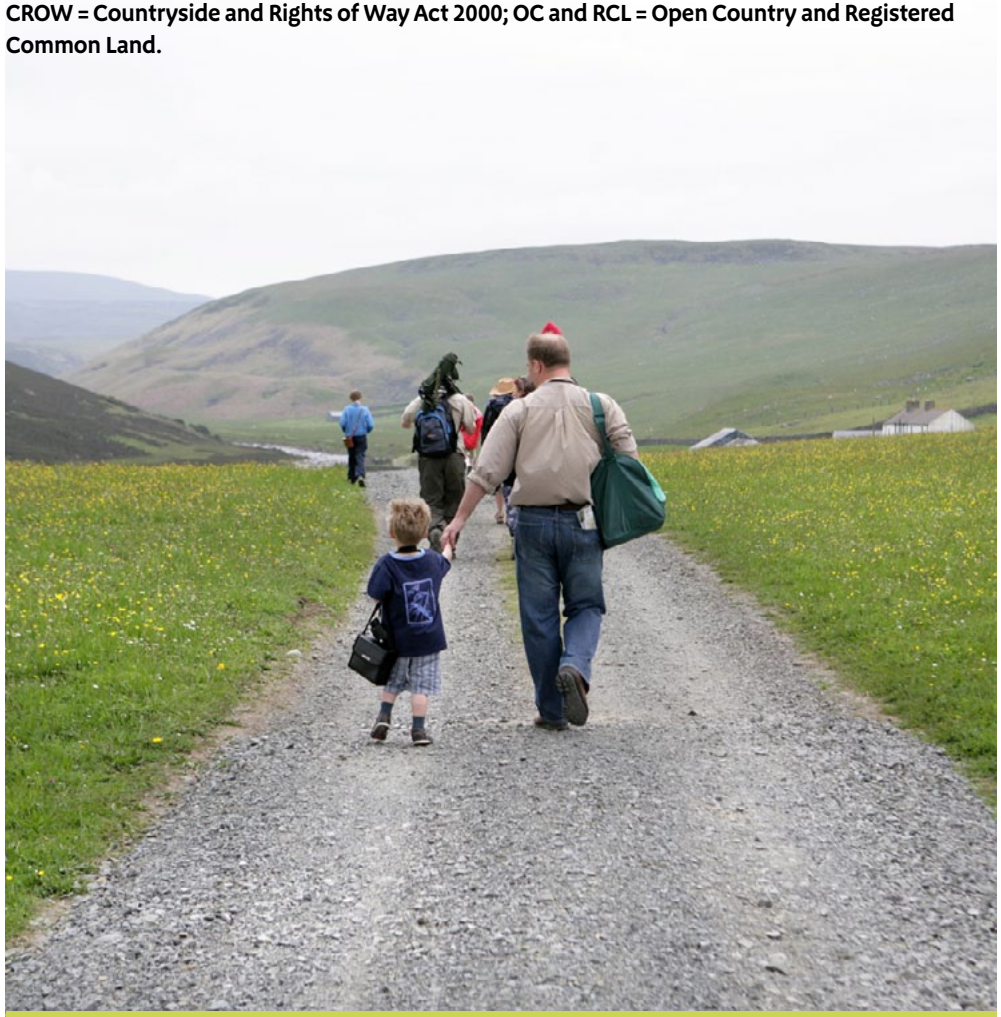
Sources: Natural England (2010)

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

Access designation	Area (ha)	% of NCA
National Trust (Accessible all year)	84	<1
Common Land	55,063	26
Country Parks	19	<1
CROW Access Land (Section 4 and 16)	129,327	60
CROW Section 15	1	<1
Village Greens	68	<1
Doorstep Greens	0	0
Forestry Commission Walkers Welcome Grants	142	<1
Local Nature Reserves (LNR)	0	0
Millennium Greens	0	0
Accessible National Nature Reserves (NNR)	8,739	4
Agri-environment Scheme Access	66	1
Woods for People	2,676	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.



There are many opportunities for walkers to enjoy the wide open spaces and the wildlife, as here at Moorhouse National Nature Reserve.

11. Experiential qualities

11.1 Tranquillity

Based on the CPRE map of Tranquillity (2006) it appears that relatively low scores for tranquillity tend to occur only along the main transport routes in this NCA, particularly along the A66 from Brough to Bowes, and around the larger villages

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

Category of tranquillity	Score
Highest	137
Lowest	-36
Mean	42

Sources: CPRE (2006)

More information is available at the following address: 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 disturbed areas of land are found along the A66 route between Brough and Bowes and around larger villages such as Stanhope. Quarries and mines (active and inactive) are also a source of intrusion within this NCA. A breakdown of intrusion values for this NCA is detailed in the table below.

Intrusion category	1960s (%)	1990s (%)	2007 (%)	Percentage change (1960s-2007)
Disturbed	1	4	4	3
Undisturbed	99	96	96	-3
Urban	0	0	0	0

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are the slight increase in disturbed land and the slight decrease in undisturbed land. It is also notable that there was no change in the percentage of urban areas between the 1960s and 2007.

- More information is available at the following address: www.cpre.org.uk/resources/countryside/tranquil-places

Dramatic waterfalls are created where rivers flow over the hard outcrops of Whin Sill, with High Force on the Tees one of the most popular sites with visitors.

12. Data sources

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

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

Supporting document 2: Landscape change

Recent changes

Trees and woodlands

- Results from Countryside Quality Counts data indicate that there was only limited uptake of agreements between 1999 and 2003, to extend the woodland area. However in recent years some areas of native woodland have been created, for example by the RSPB at Geltsdale, and by the North Pennines AONB around Middleton, Alston and Blanchland, as well as through environmental stewardship grants.

- There has been some significant re-structuring of coniferous plantations in recent years involving both restoration of moorland habitats and re-stocking with broadleaved species, notably in upper Weardale and on the public forest estate at Hamsterley and Slaley.

Boundary features

- The estimated boundary length for the NCA is 6,703 km. Results from Countryside Quality Counts indicate that the total length of Countryside Stewardship agreements between 1999 and 2003 was equivalent to about 7 per cent of this total. Between 1994 and 2013 the Pennine Dales Environmentally Sensitive Area Scheme made a significant contribution to maintaining and restoring walls in the upper dales. By 2011 there were 2,207 km (32 per cent) of walls under management through the environmental stewardship scheme.

Agriculture

- The majority of holdings are grazing livestock, with 97 per cent of the farmed land either grass or uncropped. Between 2000 and 2009 the number of dairy holdings decreased from 53 to 23 (55 per cent). Over the same period sheep numbers dropped from 658,449 to 516,540 (22 per cent), and cattle numbers dropped from 54,260 to 41,305 (24 per cent). These reduced cattle and sheep numbers may reflect the impact of foot-and-mouth disease, and changes in subsidies.

Settlement and development

- Generally the development pressures are low. There has been some intrusion from development along the A66 and also within towns and villages, where the strong vernacular character has been reduced in some instances by insensitive conversions or extensions.

Semi-natural habitat

- Countryside Quality Counts data shows that by 2003 there was significant uptake of countryside stewardship agreements for upland habitats. These included enhancing heather moorland (25,442 ha) and managing heather moorland habitats (11,573 ha).

- In recent years the North Pennines AONB's Peatland Programme has been supporting peat restoration and management works, as well as increasing awareness of the habitat, supporting research and providing management advice.

- In the second half of the 20th century the extent and quality of hay meadows declined through changes in agricultural practices, in particular the move from hay to silage, along with applications of artificial fertilisers and improved drainage. Countryside Stewardship agreements for hay meadows covered 620 ha in 2003, while the Pennine Dales Environmentally Sensitive Area scheme and Environmental Stewardship also address upland hay meadow management.

- The North Pennines AONB Hay Time project, launched in 2006, aimed to restore and enhance upland hay meadows. Between 2006 and 2011 over 1,000 fields were surveyed and links made between donor and receptor sites, with locally-harvested seed spread on 193 ha of hay meadow.

Historic features

- About 64 per cent of traditional farm buildings have not been converted, and most of those remaining are still intact structurally, but not under active management.

Rivers

- The ecological status of river waters and lakes within the NCA is generally good or moderate, although some watercourses carry a high volume of peat solids in suspension, and in places there is pollution from mining spoil.

Minerals

- Mining and quarrying has over time had a significant impact on the landscape, and there are still several active sandstone and limestone quarries, and one dolerite (Whinstone) quarry. Underground mining is now limited to one small fluorite mine, while the once highly prominent cement works in Weardale has been demolished.

Small areas of broadleaved trees and scrub alongside watercourses can reduce soil erosion as well as provide shelter and food sources for black grouse.

Drivers of change

Climate change

- Climate change may bring warmer but wetter summers and warmer wetter winters.
- Unpredictable changes in rainfall patterns, notably with an increase in frequency and intensity of storm events, are anticipated.
- Warmer temperatures would result in a general shift of species northwards and to higher altitudes, along with changes to the overall mosaic of upland habitats, with possible impacts on key iconic bird species including red grouse, black grouse, golden plover, curlew, dunlin and skylark.
- Warmer summers could result in accelerating the move away from hay meadows towards more intensively managed grasslands along with arable cropping occurring further up the dales.
- Hotter drier summers would cause the drying out of the blanket bog and peaty soils, thus resulting in a loss of carbon and making the soils vulnerable to wind and rain erosion.
- Hotter drier summers could also result in a loss of montane species, and reduce water quality through increased temperatures, potentially affecting species like salmon which are sensitive to thermal stress.
- Summer droughts would increase the risk of wildfire as the soils and vegetation on the moorlands dry out.
- Wetter summers, and in particular more frequent and intense rainfall, would increase the rates of soil erosion by the fast flowing streams and rivers, resulting in loss of land, reduction of water quality through sedimentation and an increased flood risk downstream.
- An increase in storm events could also increase the risk of pollution of watercourses by heavy metals arising from spoil from past mining and quarrying activity.
- Trees and woodlands will be vulnerable to extreme weather events, especially strong winds, in such an open and exposed landscape.
- More frequent flooding of valley bottoms could affect grazing, grass production and species composition.

Other key drivers

It is anticipated that there will be continued pressure for renewable energy including hydro-power, large and small-scale wind energy developments and biomass, which may have impacts on the qualities of remoteness and wildness.

- Development of carbon credits / biodiversity offsetting / sequestration schemes may open up opportunities for the further restoration of blanket bog habitats, and also woodland creation.
- There will be a continuing need to improve water quality to meet the Water Framework Directive.
- There may be a need to increase water collection and storage on farms for livestock.
- Species-rich hay meadows will remain vulnerable to pressures to increase silage making in preference to hay making, and to reseeding, use of artificial fertilisers and drainage. Research is ongoing into the factors that affect the quality of hay meadows in the area, to improve future management.
- Agri-environment schemes are to be reviewed and continuing support will be needed to ensure flexible land management, especially to address the conservation of valuable habitats, the movement of species, and the protection of the historic environment and landscape character.
- Changes in government policy and demands for local wood fuel may promote both improved management of existing woodlands and an increase in woodland cover.
- Ash is an important component of upland woodlands, especially on limestone where it can be the dominant canopy tree, and it comprises over 60 per cent of hedgerow trees. If ash dieback takes hold, it could pose a major threat to the landscape and woodland biodiversity.
- There is likely to be a continuing lack of maintenance of drystone walls and in places walls and hedgerows are being replaced with new, often wire fencing to managed grazing regimes, which is impacting on the open landscape character.
- There will be a continuing need to understand and manage Phytophthora austrocedrae, which is affecting juniper stands in upper Teesdale.
- There is anecdotal evidence that some non-native species are increasing, notably Himalayan balsam and grey squirrel.
- It is anticipated that populations of black grouse and certain birds of prey may remain low or continue to decline.
- Pressure to restore, convert and extend traditional buildings is likely to continue, along with new house building particularly in the larger towns and villages. The use of ubiquitous modern building materials in repair and renovation affects the traditional character of settlements. Recent improved building design guidance should influence the quality of the development within the AONB.
- Some artefacts from the industrial heritage of the area remain in need of attention to prevent deterioration.
- Large-scale quarrying of sandstone, limestone and dolerite (Whin stone) is likely to continue, with pressure to extend the area and time limit of existing workings. Quarries provide constantly changing exposures of the underlying geology, which can enable improved understanding, and restoration schemes and open up possibilities for geodiversity education and recreation.

Supporting document 3: Analysis supporting Statements of Environmental Opportunity

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

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

The long tradition of rearing livestock has created a landscape within the dales of patchworks of species-rich hay meadows and pastures that also support a range of plants, invertebrates and birds.

Statement of Environmental Opportunity	Ecosystem Service																		
	Food provision	Timber provision	Water availability	Genetic diversity	Biomass provision	Climate regulation	Regulating water quality	Regulating water flow	Regulating soil quality	Regulating soil erosion	Pollination	Pest regulation	Regulating coastal erosion	Sense of place/Inspiration	Sense of history	Tranquillity	Recreation	Biodiversity	Geodiversity
SEO 1: Protect, manage and enhance the moorlands and moorland fringes of the North Pennines, with their internationally important habitats and wildlife, their sense of wildness and remoteness, and the contribution they make to climate mitigation, water quality and availability, and water flow.	↗ *	↔ **	↗ **	↗ **	↔ ***	↑ ***	↑ ***	↗ **	↗ **	↑ ***	↗ **	↔ **		↑ ***	↗ **	↑ **	↗ **	↑ ***	↔ **
SEO 2: Protect, manage and conserve the distinctive historic and geological environment and features of this area, providing access and recreation along with imaginative interpretation, to improve understanding of the landscape and its cultural development.	↔ ***	↔ ***	↔ ***		↔ ***	↗ **	↔ ***	↔ ***	↗ **	↗ **	↔ ***	↔ ***		↑ ***	↑ ***	↔ **	↑ ***	↗ ***	↑ ***
SEO 3: Manage and enhance the pastoral character of the broad dales, with their patchworks of pastures and meadows, their strong field patterns defined by drystone walls, and their stone-built field barns, farmsteads and small villages – to strengthen local distinctiveness, and to contribute to food provision, climate change mitigation, the conservation and connectivity of important habitats and the sense of history.	↗ **	↔ ***	↗ **	↗ **	↔ ***	↑ **	↗ **	↗ **	↗ **	↗ ***	↗ ***	↔ *		↑ ***	↑ ***	↗ **	↗ **	↑ ***	↗ **
SEO 4: Manage the diverse streams, becks, rivers and reservoirs to maintain their high water quality, enhance their biodiversity interest, and strengthen their contribution to the landscape character and recreational opportunities of the North Pennines, while managing water flows and maintaining water supplies.	↔ **	↔ **	↑ **		↔ **	↑ **	↑ ***	↑ ***	↗ **	↑ ***	↗ **	↔ **		↑ ***	↗ **	↗ ***	↑ ***	↑ ***	↗ **

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.
National Importance; Regional Importance; Local Importance

Landscape attributes

Landscape attribute	Justification for selection
Underlying geology of international interest gives rise to an upland landscape of open moorland ridges divided by broad pastoral dales, each with its own distinctive character; strong landform of flat hilltops, stepped profiles to valleys, with igneous intrusions of dolerite (Whin Sill) forming striking outcrops and waterfalls.	■ Massive Alston Block forms high summits of Mickle Fell, Knock Fell, Great Dun Fell and Cross Fell, up to 893 m in height, with a dramatic scarp along the west boundary, giving panoramic views out over the Eden valley to the west. ■ Layers of hard sandstones give rise to flat topped hills, with the Yoredale series of limestones, sandstones and shales forming stepped profiles to valley sides. ■ Intrusions of dolerite (Whin Sill) create outcrops with spectacular waterfalls as at High Force, Low Force and Cauldron Snout. ■ Intrusions of hot magma metamorphosed adjacent limestone to form coarse-grained marble and 'sugar limestone'. ■ Extensive cave systems, some designated as Sites of Special Scientific Interest. ■ World class geological interest recognised through UNESCO European and Global Geopark status.
Remote and extensive moorlands of blanket bog, heathland and acidic grassland, managed for sheep and grouse, supporting internationally important moorland habitats, including arctic-alpine communities.	■ Over 98,000 ha of moorland of international significance, designated as Special Protection Area for its bird populations, notably merlin, red grouse, peregrine, golden plover, dunlin and curlew. ■ Over 90,000 ha of moorland of international significance, designated as Special Area of Conservation for the mosaics of habitats including blanket bog, wet and dry heath, juniper scrub, calcareous grassland, and arctic-alpine flora. ■ Moorlands provide many benefits including inspirational experience, tranquillity, opportunities for quiet recreation, biodiversity interest, water capture and flow regulation, as well as supporting livestock and grouse shooting.
Long tradition of livestock rearing, previously combined with mining, giving rise to enclosed pastures and meadows within the dales, the strong field patterns defined by drystone walls, with small villages and dispersed farmsteads.	■ The miner – farmer economy from the 16th to the 19th centuries has left a particularly strong pattern of smallholdings with field barns and enclosed meadows and pastures in the dales, supported by common grazing on the moorlands. ■ Important role in providing hardy sheep and cattle.
Significant grassland habitats including limestone grasslands, upland hay meadows, and calamarian grasslands on mining spoil.	■ 40 per cent of England's upland hay meadows are found here, with northern species such as woody crane's bill, globeflower and melancholy thistle. ■ The sugar limestones of upper Teesdale, of international importance, support arctic/alpine species, including Teesdale violet and spring gentian. ■ Calamarian grasslands support specialised plant communities including spring sandwort, alpine pennycress and thrift, and are of European significance. ■ Over 1,600 ha of upland calcareous grassland. ■ Species-rich grasslands are often found along road and track verges.

Landscape attribute	Justification for selection
Several major rivers flow outwards from the upland block down the wide dales, with a range of freshwater habitats, offering recreation as well as supplying water for domestic and industrial use downstream.	■ Major rivers include the South Tyne, the West and East Allen, the Wear and the Tees. ■ Water quality is generally good, and rivers and streams follow largely natural courses with a range of features including riffles, shingle banks and pools. ■ Watercourses support otter, water vole, goosander and dipper, with populations of Atlantic salmon, brown trout and bullhead. ■ Reservoirs include Cow Green, Derwent, Selset and Grassholme. ■ Watercourses and reservoirs provide particularly good environments for quiet enjoyment, sailing, canoeing, angling, and wildlife watching.
A very tranquil landscape with a sense of remoteness, with a low population, slow rate of change, and extensive open moorlands with panoramic views and a unique wilderness quality, providing inspirational recreational experiences.	■ The CPRE map of tranquillity shows that much of the area is generally undisturbed and very tranquil, with lower levels only occurring along the main transport routes, notably along the A66. ■ Extensive stretches of open moorlands and rough grazing with a lack of built structures contributes to a strong sense of remoteness and wilderness. ■ Population of less than 14,000, with a settlement pattern of dispersed farmsteads on moorland fringes and in the upper dales, small villages, estates and a few small towns. ■ Long views across moorlands, out over adjacent low lying areas, and across broad dales.
Use of local stone for building and walling gives a strong unity and vernacular character to villages, farmsteads and field barns, with distinctive white-washed buildings of the Raby estate in Teesdale.	■ Strong patterns of enclosures within dales, much of it established through the 16th century farmer – miner economy. ■ Use of local stone creates strong visual cohesion and revealing links with underlying geology. ■ Dispersed farmsteads and villages, along with planned mining villages and agricultural estates.
Semi-natural woodland limited to river and stream banks, with copses around farmsteads, with fragments of juniper scrub and some large conifer plantations on the moorland fringes.	■ Woodlands over 2 ha cover 5.6 per cent of the area. ■ Ancient semi-natural woodlands cover 1,074 ha, with another 838 ha planted with non-native species. ■ Over 3,000 ha of broadleaved woodland, including good examples of upland ash, upland oak and wet woodlands, but these are often small and fragmented. ■ Juniper scrub occurs on moorland fringes and on gill sides, with more extensive stands in upper Teesdale. ■ 6,663 ha of conifer plantations, with some forests re-structured, but others still in need of re-design and re-structuring to be in sympathy with landscape and improve biodiversity value.

Landscape attribute	Justification for selection
A rich cultural history, ranging from prehistoric settlement to the industrial period with mining of lead ore and other minerals, with mines, leats, hushings, quarries and other features still evident, along with historic buildings such as non-conformist chapels, and old routes following the dales and crossing the higher land.	■ Visible evidence of bronze-age to Romano-British burial mounds and field systems on moorlands. ■ Extensive exploitation from medieval period onwards of the many mineral veins, including lead, iron, zinc and copper ores, fluorite and barytes, resulting in many features, structures and buildings within the landscape, especially in Weardale. ■ Planned estates such as at Allenheads and Nenthead for workers. ■ 214 scheduled monuments, including extensive areas of historic landscapes. ■ 1,270 listed buildings.
The distinctive landscape with its many natural features, widespread evidence of historic activity, contained settlements with a high level of tranquillity, dark skies at night and sense of remoteness, all provide a high quality environment for quiet enjoyment and recreation	■ 60 per cent of the area is open access land. ■ The Pennine Way and the Pennine Bridleway National Trails run north-south through the area, and the Hadrian's Wall National Trail cuts across in the north. ■ National Nature Reserves provide 8,739 ha of accessible land. ■ Woods for people provide 2,676 ha of woodland available for quiet recreation. ■ Historic features and sites, such as Kilhope, and geological features, such as High Force, are focal points for visitors. ■ Lack of urban and industrial development results in dark skies and high levels of tranquillity.

Landscape opportunities

- Protect the strong sense of wildness, remoteness and tranquillity on the moorlands with their lack of man-made infrastructure (such as tracks, fences) discouraging sources of disturbance and limiting inappropriate development.
- Protect and enhance the contrasts between the remote moorlands, moorland fringes and the more settled and enclosed pastoral dales, with their historic settlement patterns of small villages and dispersed farmsteads.
- Protect, conserve and manage the extensive moorlands by encouraging sustainable mixed livestock farming and grouse moor management to maintain and enhance their international biodiversity interest, including blanket bog, mires, wet and dry heath, and the populations of birds, such as black grouse, raptors and waders.
- Protect and manage the rare arctic-alpine communities, the montane heath and the species-rich grasslands of the sugar limestone.
- Restore areas of bare and degraded peat, by blocking grips and managing through careful grazing and burning regimes, to encourage full vegetative cover and active peat formation.
- Restore or create small areas of open woodland and scrub on moorland fringes and in gills, in particular to encourage black grouse.
- Manage calcareous grasslands through responsive grazing regimes to sustain and enhance their biodiversity interest.
- Encourage the management of pastures within the dales to create a patchwork and diversity of grassland types, including rushy pastures, to provide feeding, roosting and breeding places for birds.
- Encourage and support the agricultural practice of hay making, to maintain and enhance the species-rich meadows, and ensure that adjacent land management does not adversely impact on their interest.
- Restore and expand species-rich pastures and hay meadows, identifying seed sources and continuing to research and develop ways of enhancing meadows.
- Manage road and track verges to form a network between semi-natural habitats and enable species movement, and to enhance the visitor experience.
- Manage watercourses and freshwater habitats to create a range of conditions to encourage fish and invertebrate populations whilst also finding suitable locations to provide for recreation such as canoeing, angling and wildlife watching.
- Protect existing broadleaved woodlands and bring them into effective management, and encourage natural regeneration of native broadleaved species by fencing to prevent grazing, to make them resilient and ensure their long-term survival.
- Extend and buffer existing woodlands, especially ancient woodlands, and seek opportunities and to create new small woodlands, wood pastures and scrub in suitable locations such as on steep slopes, gill sides and valleys, linking them with other semi-natural habitats where possible.

- Encourage the further restructuring of conifer forests to ensure that woodlands make a more positive contribution to the landscape, through re-shaping geometric plantations to fit more sympathetically into local landform, and improving the range of habitats by increasing the proportion of broadleaved species and open space.

- Protect, manage and expand stands of juniper scrub, by fencing to exclude grazing, to encourage its natural regeneration and improve its condition so that it is more resistant to disease, and by supplementary planting of juniper of local provenance to augment existing stands, and following guidance on disease control.

- Restore and maintain the strong patterns of drystone walls and field barns, using local stone for repairs where possible, to retain them as key historic landscape features and keep the visual link with the underlying geology.

- Manage the calamarian grasslands, to protect their specific plant communities, and link to interpretation of the mining heritage to improve understanding of their significance.

- Identify large-scale historic landscapes which have high incidence of inter-related features linked to the history of early lead mining and other mineral exploitation, including smelt mills, hushes, flues, lime kilns, and seek ways of protecting, managing and interpreting them.

- Provide access and interpretation where possible to enable more people to visit, enjoy and understand these extensive historical landscapes which provide clear opportunities for understanding the interconnections between the physical geography, natural history and historical development of the area.

- Protect and manage the many designated sites of international and national significance for their geodiversity interest, encourage further research and provide imaginative interpretation where appropriate, to build the area's reputation as a Global Geopark.

- Develop the network of locally important geological sites, providing access for interpretation and education where possible.

- Make key geological and historical sites accessible, linking them to public rights of way to form circular routes taking in a number of landscape features and sites, and linking them to tourism facilities to encourage quiet enjoyment and eco-tourism.

- Work collaboratively to prevent damage to historical sites and control the collection of minerals and mining artefacts.

- Protect and restore traditional vernacular buildings, including the dispersed farmsteads, field barns, bastles and buildings within the villages, for example schools and non-conformist chapels, using local building stone and stone or slate for roofs, and local techniques and styles, to retain historic integrity, unity and character of the settlements, and making clear their links to the underlying geology.

- Ensure that new developments, including highways schemes, use local materials and styles, to ensure their integration into the landscape and avoid introducing inappropriate elements more suited to urban locations.

- Encourage an increase in public engagement with the natural environment through for example providing opportunities for research and practical conservation.

Ecosystem service analysis

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Food provision	Livestock production	This is an important area for rearing livestock, but climate, topography altitude and poor soils all affect productivity, with little opportunity for arable crops except in the lower dales. 94 per cent of the land is Agricultural Grade 4 or 5. Sheep remain the most numerous livestock.	Regional	A long history of livestock rearing has largely created the landscape of today. Much of the farming practiced here can be considered as high nature value farming, based on low intensity, working with natural processes, and supporting wider biodiversity. Food security is likely to become increasingly important, but there is probably only little potential for increasing the production of livestock in this area. Increased numbers of stock could impact negatively on soil erosion, water quality, water storage, carbon sequestration and biodiversity. Careful management would be required to achieve sustainable increases. Climate change may result in arable cultivation extending further up the dales. There may be scope for developing local and specialist markets, benefiting from the links with the distinctive landscape.	Work with farmers and land owners to encourage and seek support for the production of food in ways that optimise productivity while maintaining biodiversity, historic features and landscape character and quality. Ensure that any future land management changes to increase food production also improve the resilience of habitats and species to climate change, minimise carbon emissions, increase carbon sequestration and have beneficial impacts on water quality and storage. Ensure future agri-environment schemes are used to best effect to conserve the wildlife habitats and traditional skills associated with upland livestock farming. Promote the links between the iconic landscape with its environmentally sensitive land management practices, and the high quality food produced. Develop stronger branding for locally produced food, thereby maintaining farming and the associated cultural landscapes and wildlife that they support.	**Food provision** **Sense of place / inspiration** **Biodiversity** **Climate regulation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Timber provision	Existing woodland	Woodland cover is relatively low, at just over 5 per cent, but some 3 per cent is coniferous (6,663 ha) and managed primarily for timber production, as at Hamsterley Forest. Many of the woodlands are small and not easily accessible. Semi-natural woodland is largely restricted to river banks and steep slopes of valleys and gills. Semi-natural woodlands tend to be small and isolated, and the woodland resource generally remains very fragmented, and thus vulnerable to poor or lack of management. Woodlands are often grazed through by livestock which prevents natural regeneration and suppresses ground flora.	Regional	The forest industry within the North Pennines includes some extensive conifer plantations, one sawmill and some local suppliers of timber products. The large conifer forests in the public forest estate are managed for wildlife interest and recreation, as well as timber production. Broadleaved woodlands tend to be small and under-managed, but there is potential to increase their productivity. Bringing both coniferous and broadleaved under-managed woodlands into management could increase local, small-scale production of woodfuel. With much of the land used for livestock rearing and sporting interests, and extensive areas of peat on the higher land, places for woodland creation are limited to gills and lower hillsides. Increasing areas of woodland in suitable locations and using native species could benefit biodiversity as well as improving water infiltration and carbon storage, reducing soil erosion, and contributing to regulating water flows. New plantations could be established on steep slopes, valley sides and in gills, on areas of bracken or acid grassland, and shaped in sympathy with local landform.	Ensure that woodlands are under sound management to increase timber productivity, including woodfuel, whilst creating habitats for wildlife and enhancing the upland landscape. There are possibilities for creating new plantation woodlands where they will fit into the local pattern of woodland cover, on lower side slopes or in gills, and where they have no adverse impacts on biodiversity interests or historic features. Encourage further restructuring of conifer plantations through felling, re-stocking with some broadleaves and reshaping to benefit timber provision and environmental interests.	**Timber provision** **Climate regulation** **Water availability** **Regulating soil erosion** **Sense of place / inspiration** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability	Reservoirs Rivers / streams High levels of precipitation Extensive areas of semi-natural habitats	The NCA does not overlay any major aquifers. Surface water resources over much of the area have 'water available' status with the exception of the River Gelt whose headwaters rise in the north-west boundary of the area and have 'no water available'. This lack of water is impacting on the international wildlife importance of the River Eden downstream. This is a large catchment area with a high rainfall, drained by several major rivers including the Tees, Wear, South Tyne, East and West Allen. There are several large reservoirs, including Cow Green, Derwent, Grassholme, Selset, Hunderthwaite and Balderhead. Water infiltration and storage is supported by the large expanses of blanket bog (64,685 ha) and upland heath (34,345 ha). Other areas of semi-natural habitats include grasslands (over 2,000 ha), and woodland (11,500 ha).	Regional	High rainfall combined with impervious rocks has led to the construction of reservoirs to provide drinking water for the region, as well as for industrial uses downstream in Tyneside, Wearside, Teesside and Carlisle. Water can be transferred from Kielder Reservoir (located to the north, in the Borders, Moors and Forest NCA) into the Derwent Reservoir and by tunnel into the Tyne, Wear and Tees to maintain the water supply for the major abstractions downstream. The rivers also have a role to play in maintaining water levels in canals. The high proportion of semi-natural habitats along with land management practices associated with low-intensity farming assist with maintaining good water infiltration and storage of surface water. This could be increased by extending wetland and woodland habitats within floodplains, and by increasing flood storage areas within the valleys. Moorland management that achieves good vegetative cover, including mosses and cotton grasses, and encourages active peat formation would improve water infiltration rates and holding capacity, whilst also improving carbon capture. Blocking grips can improve the condition of the peat and encourage active peat formation. Climate change may result in more unpredictable rainfall. Drier summers could result in an increase in demand for on-farm water storage. If designed carefully, such storage areas could contribute to biodiversity interest. Climate change may also affect the semi-natural habitats and create conditions unsuitable for some species. Measures to mitigate such changes include ensuring that existing habitats are managed so that they are robust and in good condition; buffering and expanding existing habitats to make them more resilient; linking semi-natural habitats and providing stepping stones so that species can move more easily through the landscape.	Encourage moorland management which achieves good vegetative cover, thus improving water infiltration rates, soil structure and moisture holding capacity, as well as carbon capture. Restore eroded areas of peat and ensure that subsequent management is responsive and achieves good vegetative cover. Encourage the restoration of good hydrological conditions for peat formation by blocking grips and adopting grazing and burning regimes that avoid damage to the underlying peat, thus increasing moisture holding capacity. Seek opportunities to extend floodplain storage areas and to extend wetland habitats such as reedbeds, wet pastures and wet woodland, to improve infiltration as well as holding capacity. Seek opportunities to buffer and extend existing semi-natural habitats. Ensure that on-farm water storage is designed to enhance the local landscape and biodiversity interest, for example by careful site selection, avoiding adverse impacts on historic features or wildlife, developing marginal vegetation and managing to maintain clean oxygenated water.	**Water availability** **Biodiversity** **Regulating water quality** **Climate regulation** **Sense of place / inspiration** **Recreation** **Food provision**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Genetic diversity	Livestock rearing	This is an important area for rearing hardy hill livestock; in 2009 there were over 500,000 sheep, and over 40,000 cattle.		This is an important area for rearing hardy sheep breeds, notably Teeswater, Border and Blue-faced Leicester, Dalesbred, Swaledale and Wensleydale, and hardy cattle breeds, notably Galloway and Belted Galloway.	See 'Food provision'	**Genetic diversity** **Food provision** **Sense of place / inspiration**
Biomass energy	Existing woodland	Woodland covers over 5 per cent of the area; with 3,172 ha broadleaved and 6,663 ha coniferous.	Local	The existing woodland cover offers some potential for the provision of biomass, both through bringing unmanaged woodland under management and as a by-product of commercial timber production. Production of woodfuel would need to be linked to local initiatives, such as installing wood-fired boilers in community buildings. The upland areas of the Pennines have low potential yields for short rotation coppice although yield potential is high on the lower land on the periphery. Potential Miscanthus yields are similarly low, but medium on the lowland peripheral areas.[5] The topography, climate and predominant use of the land for livestock grazing makes it unlikely that there will be many possibilities for expanding the area dedicated to biomass.	Manage existing woodlands so that surplus timber could be used to provide local sources of woodfuel. Seek opportunities to create new productive woodlands where they fit into the local pattern of woodland, and where they have no adverse impacts on historic features or biodiversity interest. Create new small-scale woodlands using native species in gills and on lower slopes, to provide wood fuel and enhance sense of place and biodiversity interests.	**Biomass energy** **Timber provision** **Biodiversity**

[5] Opportunities and optimum sitings for energy crops within the North East region, Natural England (accessed March 2013; URL: www.naturalengland.org.uk/ourwork/farming/funding/ecs/sitings/north_east_region.aspx)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation	Peat soils and blanket bog Other soils Existing woodland Semi-natural habitats	The soils over some 62 per cent of the area have a high carbon content (20–50 per cent), in particular those underlying blanket bog (64,685 ha), upland heath (34,345 ha), and areas of unimproved grassland. Carbon storage is also provided by woodland (11,500 ha) and the underlying humus-rich soils.	International	Significant volumes of carbon are stored within the extensive peat and peaty soils in this area. In some instances poor management such as high grazing levels or inappropriate burning regimes and wildfires, have affected these soils. Blanket bogs sequester carbon where there is a good active sphagnum moss layer, whilst damaged bogs release significant amounts of stored carbon. The hydrology can be improved by blocking grips followed by appropriate management. Climate change that results in warmer drier summers could cause peat soils to dry out and thus be vulnerable to oxidation and subsequent loss of carbon, as well as affecting the vegetation. Carbon sequestration and storage could be further enhanced by more sympathetic moorland management, the restoration of areas of bare and eroded peat, and the encouragement of active peat formation through grip blocking. Existing woodlands need to be managed so that growth rates are enhanced and their carbon storage potential is improved. An increase in woodland cover would also be beneficial. Low input extensive livestock systems can contribute to sustaining carbon-rich soils, as well as reducing the use of artificial fertilisers. Areas of wetland, such as permanent wet pastures that are not ploughed and reseeded, could be expanded and appropriate management could be introduced to increase the carbon storage of soils in grassland areas.	Ensure that all areas of blanket bog, wet heath and mires are under appropriate management. Prioritise the restoration of bare and eroded peatland habitats, through grip blocking and carefully managed grazing regimes. Ensure that moorland habitats are managed to encourage a robust cover of vegetation, making them more resilient to climate change effects. Encourage sustainable and extensive grazing regimes on permanent pastures and meadows with low input of artificial fertilisers. Ensure existing woodlands and plantations are under sound management thus improving their role in capturing carbon. Create new woodland in gills and on lower valley sides, and on mineral soils, where it contributes to local landscape character and biodiversity, and does not affect historic features. Seek opportunities to extend areas of wet grassland along valley bottoms. Identify ways of connecting semi-natural habitats and providing stepping stones, to facilitate the movement of species through the landscape.	**Climate regulation** **Regulating water flow** **Regulating water quality** **Regulating soil erosion** **Regulating soil quality** **Biodiversity** **Sense of place/ inspiration**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	High levels of precipitation Many fast-flowing streams and rivers Extensive areas of semi-natural habitats including moorland, rough grazing and woodland	Water quality is predominantly good, but there are some issues of diffuse pollution, and point source pollution from mining spoil, and polluted gravels remain an issue in some catchments. There are also instances of discolouration of water from an increased load of peat solids arising from erosion of bare peat soils on the moorlands. The ecological status of river waters is generally good or moderate. The chemical status of groundwater is poor, although there are no major aquifers[6].	Regional	The generally good water quality is due to the high coverage of semi-natural habitats, extensive farming systems and low population. High rainfall and steep gradients to watercourses result in rapid run-off, which increases the erosion of the channels and thus the sediment load. This has effects on both the water quality and ecological value of rivers downstream, especially after heavy rainfall. The presence of moorland grips can speed up the rate of run-off and thus exacerbate the scouring of watercourses. Climate change is likely to result in more frequent and heavier storm events, which will also exacerbate the situation. Managing moorlands so that a good vegetative cover is maintained will aid infiltration and reduce the rate of run-off and sedimentation. Bare and degraded peat, in some instances exacerbated by the construction of tracks, is particularly vulnerable to erosion, and as well as contributing to sediment load, this causes water discolouration issues which can be more effectively addressed at source than by expensive water treatment downstream. On farmed land, water quality can be affected by diffuse pollution from applications of manure, artificial fertilisers and other chemicals. Soil erosion leading to sedimentation of water courses can occur through over-grazing, or allowing livestock to poach or erode river banks. Maintenance of permanent grassland, or introducing scrub or woodland along watercourses, can aid infiltration and reduce soil erosion, especially on steep slopes. Climate change might result in drier summers which would reduce the river flows, thus affecting water quality especially on the River Gelt. The River Eden to the west is designated as a Special Conservation Area, so maintaining high water quality in the tributaries is important. Mining spoil and river gravels contaminated by heavy metals often support important calamarian grasslands, which need to be managed to maintain their specialised communities whilst reducing the potential for erosion and sediment run-off.	Restore areas of bare peat and improve the management of degraded peat habitats, to reduce erosion and colouration of the water. Improve the management of moorland, including blanket bogs, to ensure good vegetative cover that aids water infiltration and reduces soil erosion. Encourage livestock management that minimises inputs of fertilizer, manure and chemicals. Manage grazing levels and restrict access to watercourses by livestock to avoid poaching and the erosion of river banks. Manage and extend areas of permanent grassland, scrub and woodland, along watercourses. Seek ways of reducing pollution from mining spoil, for instance by creating reedbeds to capture pollutants, whilst ensuring that calamarian grasslands are managed to maintain their distinctive plant communities.	**Regulating water quality** **Biodiversity** **Regulating soil erosion** **Regulating water flow** **Recreation** **Sense of place / inspiration**

[6] Northumbria River Basin Management Plan, Environment Agency (December 2009) (accessed March 2013; URL: http://environment-agency.gov.uk/research/planning/124807.aspx)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow	Headwaters of several major rivers Reservoirs Peat soils and blanket bog	There are three main catchments with major rivers rising in the North Pennines – the Tyne, the Wear and the Tees. There are also several short becks that drain the west-facing slopes and flow into the river Eden. The headwaters of these major rivers are fed by high rainfall and drain extensive moorlands. The greatest flood risk is downstream of this area, particularly affecting settlements as far apart as Carlisle, Newcastle, Gateshead, Hexham, Durham and Middlesbrough.	Regional	With high rainfall and steep river gradients run-off can be rapid, with the watercourses reacting quickly. This could be exacerbated by an increase in frequency and scale of storm events arising from climate change. Improving the management of land in these upland areas can reduce the amount and rate of run-off, which will benefit the many urban and industrial areas downstream by reducing the magnitude of flood waters. This is the preferred approach of the Environment Agency to river flood risk management. There may be scope to improve and extend wetlands in valleys to function as washlands. Also by allowing rivers to follow more natural courses, and extending the areas of temporary flood storage in the valleys, the energy and quantity of river flows can be reduced, thus also reducing erosion and improving ecological quality downstream. Summer droughts leading to reduced summer flows and warmer water temperatures arising from climate change could have an adverse impact on river ecology and water quality, with some species, for example salmon, experiencing thermal stress.	Manage blanket bog and heather moorland to ensure good vegetative cover to aid infiltration and storage capacity of the peaty soils. Seek opportunities to expand areas of wetland habitats, in particular wet pastures along the valley bottoms, through creation of more washlands and flood storage areas. Seek opportunities to create gill woodlands and wet woodlands in valleys to slow water flows. Adapt land management practices to reduce run-off, such as pond creation or a reduction in drainage. Allow rivers to revert to more natural courses in valleys, thus extending washlands and floodplains, and diffusing the energy of floodwaters. Extend areas of permanent pasture and semi-natural habitats such as woodland to improve infiltration of water.	**Regulating water flow** **Regulating soil erosion** **Regulating water quality** **Biodiversity** **Sense of place /inspiration** **Recreation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil quality	Underlying rocks Blanket bog Soils Semi-natural habitats Permanent grassland Woodland	This area has 9 main soilscape types: blanket bog peat soils (34 per cent); slowly permeable wet very acid upland soils with a peaty surface (25 per cent); slowly permeable seasonally wet acid loamy and clayey soils (25 per cent); freely draining slightly acid loamy soils (4 per cent); freely draining very acid sandy and loamy soils (3 per cent); very acid loamy upland soils with a wet peaty surface (3 per cent); slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (2 per cent); freely draining acid loamy soils over rock (1 per cent); and raised bog peat soils(1 per cent).	Local	The blanket bog peat soils and the slowly permeable wet very acid upland soils with a peaty surface are at risk of loss of organic matter through wind and water erosion, which could be exacerbated by more frequent storm events occurring as a consequence of climate change. These soils are also at risk of losing organic matter through unsustainable management practices. The slowly permeable seasonally wet acid loamy and clayey soils can be easily damaged when wet, and may suffer compaction and/ or capping. Measures should be encouraged such as managing livestock grazing levels that support good vegetative cover and avoid poaching, and not carrying out mechanised activities that would damage the soils. Management to increase the levels of organic matter in the soils can also help reduce these problems.	Ensure that the management of the pastures and meadows will encourage the build up of organic matter, for instance through extensive grazing regimes, which will also reduce the risk of poaching by livestock. Manage moorland habitats to encourage vegetation and peat formation, for example by introducing responsive grazing regimes, and blocking grips to raise water table levels to safeguard the carbon-rich soil. Avoid carrying out mechanised activities that will cause compaction of soils, especially in wet conditions.	**Regulating soil quality** **Regulating soil erosion** **Regulating water quality** **Regulating water flow** **Food provision** **Biodiversity** **Sense of place / inspiration**
Regulating soil erosion	Soils Blanket bog Semi-natural vegetation Permanent grassland Woodland	A significant proportion (62 per cent) of the soils is peaty and prone to wind and water erosion. These soils include: the slowly permeable wet very acid upland soils with a peaty surface (25 per cent) and blanket bog peat (34 per cent) which are at risk of gullying / hagging; very acid loamy upland soils with a wet peaty surface (3 per cent), which are often found on steep slopes, and thus subject to a combination of rapid runoff and easily damaged peat layers; freely draining very acid loamy soils (3 per cent) and freely draining slightly acid loamy soils (4 per cent) especially where they occur on steep slopes.	Regional	Important issues here include ensuring that these soils retain water in situ, have good permanent vegetative cover and are not overgrazed, overburned or subject to trampling, poaching or damage by mechanised activities, especially on steeper slopes. Drainage of peaty soils can result in increased oxidation of carbon and soil loss. The blanket peat soils are also vulnerable to occasional mass flow events, an increasing risk if climate change results in more frequent storm events. They can also be affected by wind erosion where there is a lack of covering vegetation. Poaching and compaction on soils with poor drainage when wet can result in poor water infiltration and increased surface water run-off, the latter causing diffuse pollution. The risk of erosion of soils by wind and rain, especially on steep slopes, can be addressed by ensuring permanent grassland, woodland or other semi-natural habitats are created and maintained on steep slopes.	On farmed land, ensure soil erosion is reduced by encouraging the adoption of sound land management practices including managing grazing levels, and restricting access to watercourses by livestock. Prioritise the restoration of bare and eroded peatland habitats. Ensure that moorland grazing and burning practices result in good vegetative cover and allow the establishment of an active Sphagnum layer on blanket bogs. Seek opportunities to establish permanent grassland and woodland along the steep slopes within gills and valleys, and alongside water courses.	**Regulating soil erosion** **Regulating water quality** **Biodiversity** **Sense of place / inspiration**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pollination	Extensive semi-natural habitats of moorland, rough grazing Calcareous grassland, species-rich meadows and pastures Road verges	Upland blanket bogs, the open moorland and mosaics of heather, cottongrass, bilberry, bracken, acid and calcareous grassland cover 47 per cent of the area. Species-rich grasslands are also important resources, while many of the road verges are rich in flowering species.	Local	The extensive areas of semi-natural habitats support large numbers of insects and provide nectar sources for pollinators. Species-rich grasslands also contribute by providing important refuges for many pollinating invertebrates that are in decline. Techniques of spreading green hay on meadows along with careful grazing and cutting regimes can enhance the species diversity. In addition, the species-rich road and track verges provide linear resources linking the other habitats.	Seek opportunities to expand areas of species-rich grasslands on the moorland fringes and within dales. Manage hay meadows to protect their species diversity, and work to extend species-rich meadows and pastures through spreading green hay and managing grazing and cutting regimes. Seek improved management of road verges and small sites within villages, to provide networks of habitats providing nectar sources	**Pollination** **Biodiversity** **Sense of place / inspiration**
Pest regulation	Juniper scrub Upland ash woodlands and ash trees in hedges and villages	Phytophthora austrocedrae has recently infected the internationally significant stands of juniper scrub in upper Teesdale A virulent form of Chalara fraxinea is affecting ash trees in several locations in England. There are significant upland ash woodlands, where ash is the dominant canopy tree, in this NCA, and ash forms 60 per cent of the hedgerow trees in the AONB.	Local	Natural regeneration of juniper is poor, and can be encouraged by excluding grazing, with supplementary planting of local provenance juniper carried out in some places. Phytophthora is now affecting some stands, and infected scrub has to be cut out and burnt. Biosecurity measures have been adopted, so that walkers entering and leaving the area are asked to disinfect their footwear to prevent transmission of the disease. Attention will need to be paid to the occurrence of ash dieback, which would have a significant impact on upland ash woodlands and ash trees in hedgerows and around villages.	Encourage the protection and regeneration of resilient stands of juniper scrub by fencing to exclude livestock Carry out juniper scrub clearance and burning where infected, and continue with biosecurity measures; monitor outcomes Carry out surveys of ash woodlands and trees to identify any occurrences of ash dieback, and work with landowners and managers to control its spread and introduce biosecurity measures	**Pest regulation** **Biodiversity** **Sense of place / inspiration**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of place / inspiration	Iconic and internationally recognised historic and geological sites Extensive semi-natural habitats of national and international significance Remoteness and tranquillity Open expansive moorland Broad, pastoral dales Species-rich hay meadows, limestone grasslands, woodlands, and blanket bog Waterfalls, stony outcrops	There is a wealth of historic features based on the area's geodiversity, including the built remains of the mining and smelting industries which have drawn on the availability of water and minerals. There are strong contrasts between the high, wild, remote and exposed moorland ridges with blanket bog, spectacular waterfalls, stony outcrops, limestone grasslands, coniferous plantations and reservoirs, with the broad, sheltered pastoral dales with species-rich hay meadows and small woodlands. Feelings of inspiration and escapism are associated with the wide, panoramic and uninterrupted views from the moorlands, rocky outcrops, pastures, quiet valleys and dramatic waterfalls. The presence of birds such as curlew, lapwing, golden plover, snipe, redshank and black grouse with their distinctive calls also contributes to the experience, as well as to the wildlife richness of the area. The North Pennines, Teesdale and Allendale in particular, have been a source of inspiration for artists and authors such as John Martin, J.M.W. Turner, Charles Dickens (for the book Nicholas Nickleby), and W.H. Auden.	National	The North Pennines provide one of the most remote and 'wild' experiences within England, with its expansive open moorlands and dales with low populations and few settlements. The area has a very strong and distinct landscape character, which led to 88 percent of this area being designated as an AONB in 1988. Protecting and enhancing this sense of place has the potential to increase recreational use, to benefit biodiversity and geodiversity and increase awareness of the sense of history. The area offers much to engage both residents and visitors in both enjoying and improving understanding of the landscape and its history. Whilst change has been relatively slow in the area, and development pressures remain relatively low, the landscape character can be affected by small but numerous changes, for example to buildings, roads and conversions of traditional buildings that result in an incremental 'sub-urbanisation' of the remote upland landscape. The long tradition of upland farming has effectively created the landscape, and its viability needs to be maintained and supported to ensure environmentally sensitive land management.	Protect contrasts between open moorlands and pastoral dales. Maintain and conserve the wealth of historic features; evidence of past activities over the centuries. Maintain and restore strong patterns of drystone walls, using local stone to reinforce the links with the underlying geology. Maintain settlement patterns and restore traditional vernacular buildings, using local materials and styles where possible. Protect and manage key habitats, including moorland mosaics, pastures, hay meadows, broadleaved woodlands and flower-rich road verges. Maintain quality of watercourses and reservoirs, and make iconic features such as waterfalls accessible to the public where possible. Seek ways of supporting environmentally sensitive upland farming.	**Sense of place / inspiration** **Sense of history** **Recreation** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	Prehistoric earthworks and burial mounds and bronze-age settlements Medieval settlements and farmsteads Extensive evidence of early mining and quarrying Upland farms Vernacular architecture	A sense of history is largely associated with the industrial past; distinctive features include mine buildings, shafts, levels, wheel pits, chimneys, smelt mill flues, spoil heaps and the hillside scars left by "hushing". The history of upland farming can be traced through the pattern of prehistoric and bronze-age settlements with burial mounds, followed by the pattern of small villages, dispersed farmsteads on higher land, and defensible bastles. The drystone walls form a distinctive pattern, based on the enclosed fields of the smallholdings held by miner farmers from the 16th century. Later features include the big rectangular parliamentary enclosures on higher land, the planned mining villages of Allenheads, Garrigill and Nenthead, and the whitewashed farmsteads of Raby Estate. Recent survey work by English Heritage has revealed that there is more evidence of archaeology of medieval and earlier land use and settlement than previously realised.	National	With its long history, and lack of recent cultivation and development, the North Pennines NCA provides key opportunities for protecting and understanding large-scale historic landscapes. In a national context, the area has exceptionally high potential for revealing further archaeological evidence of land uses and settlement from medieval and earlier times. The area is also well known for its industrial history, with many artefacts from mining still in place. There are therefore excellent opportunities for identifying and interpreting historic features within a landscape and understanding the inter-relationships between them, the geology, climate and ecology, and society's development of land uses and activities over time. Interpretation of historic features and landscapes would ensure that more people are able to enjoy and understand the ways in which the landscape has developed over time. Social histories are also important, and the North Pennines AONB Partnership 'Living Landscapes' project has been developing interpretation for historic sites such as Shildon Engine House and Muggleswick Grange, as well as collecting the stories from surviving quarrymen, commoners and other local people to record the important social history that has shaped the area.	Seek ways of protecting and interpreting stretches of historic landscapes which contain many related artefacts, retaining evidence of the relationships between features, and thus enabling improved understanding of past activities. Ensure that key historic and archaeological features are protected and maintained. Undertake further field work to identify ground features that reveal early settlement and land uses. Provide clear and imaginative interpretation of sites and landscapes, for the enjoyment of the public. Where restoration is carried out, ensure that appropriate materials, such as local building stone, and styles and techniques are used to maintain the historic integrity of the structure.	**Sense of history** **Sense of place/ inspiration** **Recreation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Tranquillity	Expansive, open moorlands with a sense of 'wildness' and remoteness Waterfalls, rivers, pastures and meadows Few settlements or roads Dark night skies	With its low population and extensive uplands, the area is very tranquil, with some loss of tranquillity around the A66 road corridor. There has been a slight decline in undisturbed areas since the 1960s, but undisturbed areas remain high at 96 per cent in 2007 [7] The moorland landscapes of the North Pennines are regarded as being amongst England's wildest places. They have an unspoilt sense of naturalness and remoteness found in few other places.	National	The sense of wildness is a perception, as even the most remote summits are managed for grouse shooting and livestock. But there are few man-made structures on the moors (other than the Great Dun Fell radar station, grouse shooting related structures and remnants of the industrial heritage), and this along with the open spaces and often dramatic weather, can make the moors feel like a place apart. Even the more enclosed dales are quiet and relatively undisturbed, with networks of quiet roads, tracks and paths. The lack of settlement also results in relatively dark night skies.	Protect the sense of remoteness and 'wildness' by avoiding the introduction of built structures on the moorlands. Manage development so that it is contained and limited in impact. Ensure that external lighting is controlled to reduce light pollution. Manage visitor access and recreational facilities to avoid loss of tranquillity	**Tranquillity** **Recreation** **Sense of place / inspiration**

[7] Developing an intrusion map of England, Campaign to Protect Rural England (2007) (accessed March 2013; URL: www.cpre.org.uk/resources/countryside/tranquil-places/item/1790-developing-an-intrusion-map-of-england)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation	Open access land Public rights of way 3 national trails: Hadrian's Wall Path, Pennine Way and the Pennine Bridleway National cycleway Reservoirs and rivers Forests Geodiversity Historic features and landscapes Grouse moors	61 per cent of the area is accessible to the public (130,979 ha) along with an extensive network of rights of way totalling 2,182 km at a density of 1 km per km^2. In addition, 52 km of the Pennine Bridleway and 129 km of the Pennine Way run roughly north / south across the area, while nearly 2 km of the Hadrian's Wall Path cuts across the north. Also the popular C2C cycle route cuts across the area. The large Public Forest Estate also provides a range of recreational facilities, including walking, cycling, mountain biking, riding, star gazing and bird watching, with Hamsterley Forest alone receiving 200,000 visitors per annum. Grassholme Reservoir provides sailing facilities, while the many watercourses provide angling and in some places canoeing.	National	The North Pennines are well known for recreation that depends upon the natural environment, including walking, birdwatching, cycling, riding, canoeing, fishing, orienteering, geotourism, wildlife watching, star gazing, heritage tourism, grouse and pheasant shooting. In most instances these activities can be carried out whilst respecting the natural assets of the area, but any increase in levels of use would need to be managed to avoid adverse impacts on the natural assets of the area including tranquillity and biodiversity. Forests in particular can cope with large numbers of people with minimal impact and can provide good opportunities for activities such as mountain biking. Climate change that results in warmer wetter winters might impact on the survival of red grouse, thus impacting on grouse shooting.	Improve access by ensuring that paths are maintained and well signposted, and that some surfaced paths are provided for use by all levels of ability and interest at key popular locations such as at selected reservoirs and waterfalls. Provide imaginative interpretation of the landscape and its many features (for example geological, historical, species and habitats). Maintain and manage the high quality of the watercourses and waterbodies to provide good recreational experiences and ensure that there are no adverse impacts on the landscape, biodiversity, historic environment or water quality. Maintain and extend the facilities for recreational use within forests. Plan for and manage visitor numbers and recreational facilities to maintain sense of place, tranquillity, dark night skies and biodiversity interest.	**Recreation** **Regulating water quality** **Water availability** **Sense of history** **Biodiversity** **Geodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity	Special Areas of Conservation Special Protection Areas Sites of Scientific Interest Semi-natural habitats National Nature Reserves	7 SAC covering 93,579 ha. 1 SPA covering 98,413 ha, which includes Moor House / Upper Teesdale National Nature Reserve. 86 SSSI covering 47 per cent of the area. 40 per cent of England's upland hay meadows. 1,912 ha of ancient semi-natural woodland, of which 838 ha is plantation.	International	The NCA is of particularly high value for biodiversity, reflected in the large proportion of the area that is protected through national, European and international nature conservation designations. Key habitats include blanket bog, mountain heath, wet heath, dry heath, arctic / alpine flora, calcareous grasslands, upland hay meadows, juniper scrub, upland ash and oak woodland. There is also the rare 'Teesdale assemblage' of arctic / alpine flora. The area is also important for rare and iconic birds including black grouse, curlew, ring ouzel, lapwing, golden plover, merlin and peregrine, and other species including otter, dipper and water vole. Climate change effects might result in a shift northwards and / or upwards for some species. With the high proportion of open access land, all these habitats and species can be seen and enjoyed by the public. Improving the ecological condition of habitats is likely to benefit a range of other ecosystem services, for example, the high quality of the water in the many rivers and streams supports Atlantic salmon and brown trout, along with otter, water vole and dipper. However, some watercourses do not fulfil their potential as spawning grounds due to the presence of obstacles to migratory fish. Increased sedimentation of watercourses caused by erosion of river banks also reduces the quality of spawning beds. In places there are difficulties with invasive species such as Himalayan balsam, Japanese knotweed and giant hogweed. Trees and woodlands need to be made more resilient by extending small areas, linking fragmented sites, and bringing under management to make them more resilient and ensure their long term survival. Biodiversity interest can be enhanced within ancient woodland sites by bringing them into sound management to retain their biodiversity and historic interest, and native trees and shrubs should be restored in plantations on ancient woodland sites. Increasing the coverage of semi-natural habitat, restoring hydrological systems and promoting sustainable grazing regimes all have the potential to improve services such as the regulation of water quality and soil erosion, whilst also contributing to sense of place and inspiration.	Protect, restore and extend priority habitats and designated sites, and ensure appropriate management of adjacent land to increase the area considered to be in good ecological condition. Create and maintain habitats including blanket bog, heather moorland, and adjacent rough pastures; species-rich grasslands and hay meadows; broadleaved woodland and scrub; freshwater habitats, seeking locations that link or provide stepping stones between existing habitats, to allow species to move more freely through the landscape. Ensure water quality remains high, thus supporting freshwater species and creating links along watercourses to enable species movement, whilst also carrying out management to control invasive species. Remove artificial obstacles to the passage of salmonids (salmon, sea and brown trout) upstream to spawn. Protect ancient woodland sites, and bring plantations on ancient woodland sites under management to restore native trees and shrubs. Within forest management plans, seek opportunities to restore open heathland habitats where appropriate, with compensation planting carried out elsewhere. Increase and improve the interpretation of the rich biodiversity of the area, and encourage ecotourism that respects, reveals and explores the wildlife.	**Biodiversity** **Sense of place / inspiration** **Regulating water flow** **Regulating water quality** **Climate regulation** **Sense of history**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	Upland block largely formed by Carboniferous rocks Many mineral veins Igneous intrusions of dolerite at Whin Sill Sugar Limestone Frosterley Marble	Britain's first UNESCO endorsed European Geopark in 2003. UNESCO endorsed Global Geopark in 2004. 18 Geological Sites of Special Scientific Interest. 13 Local Geological Sites.	International	The many designated sites provide important, and often accessible, exposures of underlying rock allowing for the interpretation, understanding and continued research into the geodiversity of the area. Exposure of these features also makes a positive contribution toward sense of place and sense of history. Some disused quarries, such as Ashes Quarry at Stanhope, also provide important habitats for wildlife. The exploitation of minerals reveals the importance of the geology to the historic development of the area. The quarrying of stone used for building has provided long lasting and robust buildings with strong visual unity in towns and villages, and revealing clear connections with the underlying rocks. Frosterley Marble is a particularly highly prized building stone, used for important local buildings and church fonts, as well as in Durham Cathedral and further afield.	Protect geological features, both natural and from past workings such as old quarry sites and mines, and improve access to these areas where possible, for research, enjoyment and education. Provide further interpretation to improve of the many geological features within the North Pennines. Identify opportunities for enhanced access to geological sites and features Maintain drystone walls and vernacular buildings using local stone wherever possible, to reinforce links with underlying geology	**Geodiversity** **Recreation** **Sense of history**

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Catalogue Code: NE428

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