National Character Area profile:

2. Northumberland Sandstone Hills

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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.

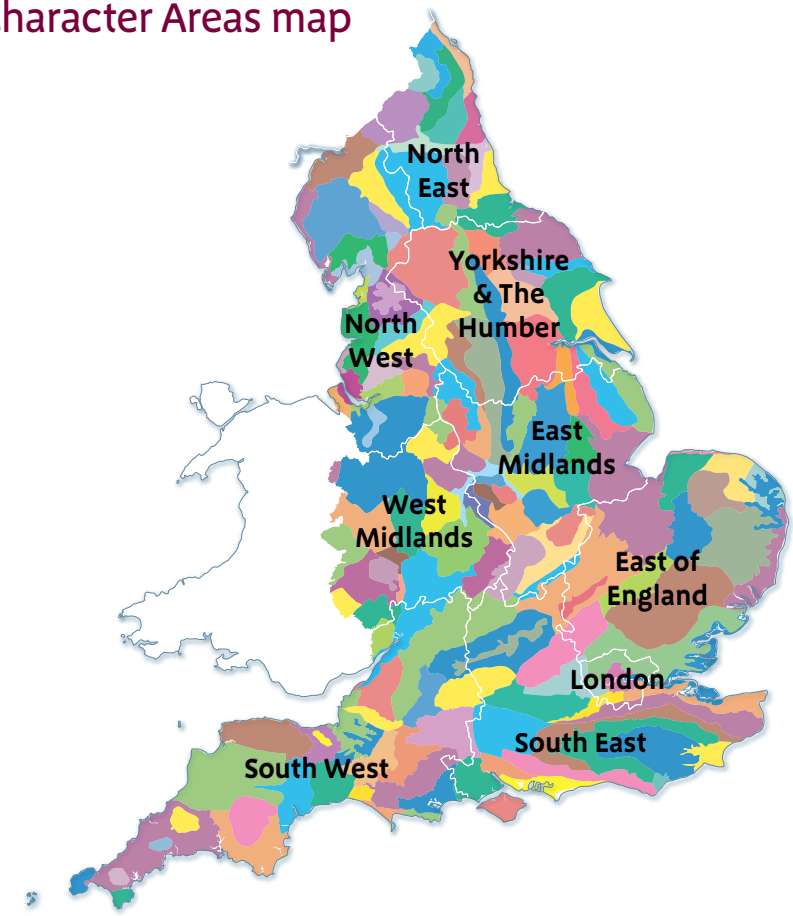
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and 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 Northumberland Sandstone Hills curve across central Northumberland in a series of distinctive flat-topped ridges which provide panoramic views of the Cheviots and the coast.

The ridgetops and upper slopes are covered with heather and grass moorland broken by large geometric blocks of conifer. Below this is pasture with some arable cultivation on the lower and dip slopes, broadleaved woodland on scarp slopes and along watercourses and a few notable parklands. There is a long tradition of rearing hardy sheep and cattle in this area.

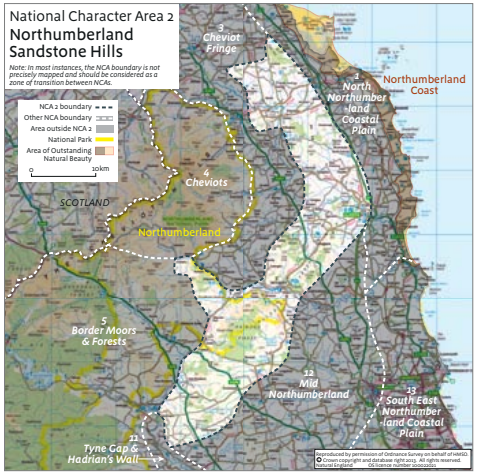
A number of major rivers flow east to the coast: the Wansbeck and Font arise in the Sandstone Hills while the Aln and Coquet break through from the Cheviot Fringe. The Till meanders through the lowlands of the north-west corner of the National Character Area (NCA). The Till and Coquet are designated for their biodiversity value and are important game fisheries.

The Sandstone Hills play an important role in the recharge of the Fell Sandstone Aquifer; the quality and availability of water in this NCA are important for the supply of water locally and to northern Northumberland, and there are opportunities to help to reduce flood risk in this and downstream NCAs.

This area, with its sparse settlement, slow change and cultural continuity, is perceived as very tranquil, valued for its open vistas and dark night skies. The largely undisturbed landscape holds significant prehistoric and medieval archaeological remains which together form some of the most interesting and nationally important archaeological landscapes in England.

Visitors are attracted by country houses and castles, and by the recreation and experiential opportunities afforded by the tranquil moorlands and valleys. The thriving market town of Alnwick and smaller service centre of Rothbury also attract visitors to the area, with Rothbury acting as a gateway to the Northumberland National Park which covers a central section of the NCA.

Future challenges for the area include continued land management which enables the restoration and enhancement of important habitats such as heath, blanket bog, broadleaved woodland and juniper scrub, and which improves water quality and groundwater recharge. The demands for timber provision must be balanced against the opportunities for reducing the visual impact of the plantations on the landscape and for large-scale restoration of open moorland habitats, as well as the continued provision of red squirrel reserves. There are opportunities to reduce soil erosion, conserve the area's distinctive archaeology and heritage assets, and reinforce landscape character by reversion of arable land to permanent grassland, particularly where sandy soils are being cultivated on scarp and dip slopes, although this will need to be balanced against future demand for food provision. One of the greatest challenges will be increasing the provision of renewable energy while preserving the open vistas and distinctive skylines.



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Statements of Environmental Opportunities:

- **SEO 1:** Conserve, restore and significantly expand the moorlands, for the habitats, the strong sense of tranquillity and landscape character, and recreational opportunities that they provide. Reduce the visual impact of conifer plantations and enhance their biodiversity value, ensuring that the moorland habitats provide a well-functioning ecosystem that will be more resilient to climate change, will continue to support nationally and internationally important species of wildlife, and will facilitate groundwater recharge of the Fell Sandstone Aquifer, while enhancing their ability to store and sequester carbon and regulate water quality and flow.

- **SEO 2:** Manage and enhance the farmed environment, providing a mosaic of grassland types and structures to benefit wildlife such as breeding waders and hen harrier, supporting the long tradition of rearing hardy livestock in this area, including preserving the rare breed of Chillingham wild cattle, strengthening landscape character, contributing to food provision and managing cropped areas to minimise soil erosion.

- **SEO 3:** Enhance the connecting corridors of streams, rivers and waterbodies, expanding and linking fragmented habitats such as wet pastures, meadows and native woodland, improving water quality, restoring natural river morphology, promoting natural flood management and exploring the possibility of establishing flood storage areas. This should help to protect nationally and internationally important species, ensure that the rivers and waterbodies retain their reputation as renowned game fisheries, and help to reduce the risk of settlements flooding in this and downstream NCAs.

- **SEO 4:** Protect, manage and conserve the area's distinctive historic and geological environment with its wealth of archaeological and built heritage assets from 'cup and ring' marked rocks to Alnwick Castle, and the distinctive geological features including the iconic Simonside crags, providing access to these valuable resources and encouraging their use in research and education to improve understanding and enjoyment of the landscape and its cultural development.

The Northumberland Sandstone Hills form an arc of distinctive ridges characterised by generally level tops, north-west facing scarp slopes and craggy outcrops.

Description

Physical and functional links to other National Character Areas

The Northumberland Sandstone Hills NCA extends north-east in an arc from the Border Moors and Forests NCA, with the Tyne Gap and Hadrian's Wall NCA to the south and the Mid Northumberland NCA to the south-east. It encircles the lowland plains of the Cheviot Fringe to the west, separating them from the lowlands of the North Northumberland Coastal Plain and Mid Northumberland NCAs to the east. The hills provide panoramic views of the Cheviots to the west, the coast to the east and Scotland to the north, and form the backdrop to views inland from the coast.

The River Till arises in the Cheviots, flows across the Cheviot Fringe and then gets deflected by the Fell Sandstone ridge to run north to join the River Tweed. The rivers Coquet and Aln, which have arisen in the Cheviots and Cheviot Fringe respectively, meander across the Cheviot Fringe and break through the Northumberland Sandstone Hills to flow east to the coast. The rivers Font and Wansbeck arise in the Northumberland Sandstone Hills and also flow east to the coast. While there is some flood risk in this NCA, particularly around Rothbury on the Coquet, the greatest flood risk occurs in downstream NCAs. The Coquet, Wansbeck, Font and the Fell Sandstone Aquifer, part of which underlies the north-western tip of this NCA, provide public water supply for much of northern Northumberland whereas the rivers Till and Aln predominantly provide water for crop irrigation in the Cheviot Fringe, North Northumberland Coastal Plain and Mid Northumberland NCAs.

There are relatively few major roads but two of the three principal cross-border routes pass through this NCA with the A1 skirting around the eastern edge and the A68 cutting through to the south. Other key transport routes include the A696 and A697 linking the rural border communities to Tyneside and the A1. These transport links play an important role in the haulage of timber from this and adjacent NCAs to processing destinations and provide access for military vehicle convoys to the Otterburn Military Training Area.

There are close links with adjacent NCAs as much of the area forms the in-bye and moorland grazing component of larger holdings located in the Cheviot Fringe, North Northumberland Coastal Plain and Mid Northumberland NCAs. The middle section of the Northumberland Sandstone Hills falls within the Northumberland National Park.

The River Coquet breaks through the arc of Sandstone Hills from the Cheviot Fringe, flowing east to the coast. It is designated as a Site of Special Scientific Interest for its biodiversity value and is a renowned game fishery.

Key characteristics

- Arc of sandstone hills forming distinctive skyline features including the iconic monolith of Simonside, characterised by generally level tops, north-west facing scarp slopes and craggy outcrops.
- Exceptional panoramic views of the coast and across the lowland Cheviot Fringe to the Cheviots and Scotland.
- Heather and grass moorland provides rough grazing on the upper slopes and broad tops of the ridges, interrupted by large geometric conifer plantations, giving way to improved pasture and cropping on lower slopes and valley bottoms.
- A mixture of piecemeal and regular enclosure, bounded by drystone walls but often broken up by coniferous shelterbelts and blocks, especially in areas of regular enclosure.
- Wide valleys of the Coquet and Aln rivers pierce the arc of hills, containing remnant native woodland and a patchwork of wet pastures and arable fields, often with steep-sided bluffs and fed by incised tributaries.
- Wet peaty flushes, mires, loughs, lakes and small reservoirs occur throughout the area.
- Broadleaved woodland is associated with rivers, burns, loughs, scarp slopes and country house estates.
- Nationally and internationally important species including Atlantic salmon, brook and river lamprey, otter, water crowfoot, hen harrier, peregrine, merlin, ring ouzel, black grouse, whinchat, golden plover, dunlin, curlew, nightjar and red squirrel.
- A number of large country houses set in extensive gardens and parklands with associated broadleaved woodland fringe the lower slopes.
- Important and complex archaeological landscape, with prehistoric 'cup and ring' marked rocks, bronze-age burial cists, earthwork remains of later iron-age hill fort systems, standing stones, enclosures and cairns, extensive medieval remains, bastles and castles such as Alnwick Castle, and evidence of quarrying.
- Scattered pattern of individual isolated farmsteads and small hamlets, served by the main market town of Alnwick and smaller service centre of Rothbury. Buildings constructed from locally quarried dressed or rubble sandstone, with slate roofs.
- Tranquil, rural landscape with low population and a few strategic major roads but with increasing numbers of vertical structures such as communications masts and wind turbines prominent on the skyline.
- Moorlands, forests and sandstone outcrops provide important recreational opportunities for activities such as walking, biking, climbing and wildlife watching.

Northumberland Sandstone Hills today

The Northumberland Sandstone Hills curve across central Northumberland, standing above the coastal plain and encircling the lowland valleys of the Cheviot Fringe to the west.

The broad hill tops undulate in a series of ridges, characterised by distinctive skylines created by dramatic escarpments, sandstone boulders and craggy outcrops, and reducing in height towards the north. They are pierced by a number of rivers and streams including the Grasslees Burn and the rivers Coquet and Aln.

The ridgetops and upper slopes are dominated by heather and grass moorland which is managed as rough grazing for hardy sheep and some cattle, and a small number of estates manage their land for red grouse. The chain of moorland is interrupted by a number of extensive conifer plantations including Harwood and Rothbury forests and Harbottle, Thrunton and Kyloe woods.

Below the moorland improved pasture dominates with some cropping on the lower and dip slopes. There is a mixture of piecemeal and regular enclosure; medieval strip fields and large, regular fields from 18th- and 19th-century enclosure are bounded by drystone walls and subdivided by fencing, often broken up by coniferous shelterbelts and blocks dominated by Scots pine and spruce.

The moorlands comprise diverse mosaics of dry and wet heath, mires, blanket bog, fens, flushes, acid and calcareous grasslands and waterbodies, and support a diverse range of amphibians, invertebrates and upland birds. A number of sites are designated for their high biodiversity value: Simonside Hills and Harbottle Moors are designated as Special Areas of Conservation (SAC)

The rough grazing of the ridge tops and upper slopes gives way to improved pasture and cropping on the lower slopes enclosed by dry stone walls in a mixture of piecemeal and regular enclosure, and interrupted by geometric shelter belts and small areas of broadleaved woodland.

for their European dry heath and blanket bog habitats, and along with Bewick and Beanley Moors as Sites of Special Scientific Interest (SSSI) for their upland and woodland habitats. Holburn Lake and Moss is designated as a Ramsar site and Special Protection Area (SPA) for its lowland raised mire and greylag goose roost. Red squirrels are still found throughout this area and Kyloe, Harwood and Raylees plantations have been designated as red squirrel reserves.

Notable areas of ancient semi-natural woodland comprising oak, ash, rowan and birch occur on steeper slopes below the scarp face, along incised burns, and on the dip slopes. Nationally important relict stands of juniper are found in a few locations such as Bewick and Beanley Moors, Harbottle Moors and Simonside Hills SSSI.

The upland plateaux are drained by sometimes deeply incised tributaries which flow into the wide, fertile valleys of the rivers that cut through the arc of sandstone hills. The Aln meanders through a patchwork of arable and pasture enclosed by hedgerows, with localised parkland influences, small woodlands and conifer blocks. The highly dynamic Coquet, much of which is designated as SSSI for its woodlands and the species that it supports such as salmon, lamprey and otter, passes through steep, wooded bluffs. It meanders unrestricted through the gravel terraces of the flood plain or 'haugh', forming oxbow lakes and channel braiding. Remnant alder woodland still lines many of the watercourses and rich communities of upland oak and birch woodland are found in the gorges of the Coquet Valley.

The River Till, part of the River Tweed SAC, meanders through the lowlands of the north-western corner of the NCA. Many of the rivers and waterbodies in this NCA are important game fisheries.

Large reservoirs, natural loughs and lakes, often fringed with mixed woodlands, are prominent features of the landscape, as are the many quarries, mostly disused, which are scattered throughout the Sandstone Hills. A number of castles and country houses lie at the foot of the hills. These are typically set within gardens and parkland and include Alnwick Castle, Cragside and Chillingham Castle (famous for its herd of wild white cattle).

The Northumberland Sandstone Hills contain a variety of prehistoric sites including 'cup and ring' marked rocks and iron-age hill forts, which together form some of the most interesting archaeological landscapes in England. The extensive medieval remains including deserted villages, ridge-and-furrow cultivation patterns and bastles, and the Roman roads of Dere Street and the Devil's Causeway with their associated marching camps and forts also contribute to the complexity of the historic landscape. Deserted medieval settlements and earlier monuments are concentrated in the moorlands, although they are also found across the farmed landscapes of this area.

Settlement in the Northumberland Sandstone Hills is sparse and characterised by a scattered pattern of individual isolated farmsteads and small hamlets, and by the market towns of Alnwick and Rothbury; there are no large settlements. The busy market town of Alnwick is located at the foot of the hills where the Great North Road (A1) crosses the River Aln. As the main town in the area, it is a focus for tourism and other development, retaining a distinctive historic character strongly influenced by Alnwick Castle, the grounds of which were laid out by Capability Brown. Rothbury, the 'capital of Coquetdale' and gateway to the Northumberland National Park, is also a thriving tourist centre, sited on the north bank of the River Coquet where it breaks through the Sandstone Hills.

The estate farmlands to the north around Alnwick tend to comprise large fields and farmsteads, the central area is interspersed with enclosed blocks of moorland, and to the south of the Coquet dispersed, smaller-scale settlement predominates. Buildings are traditionally constructed in locally quarried sandstone, either rubble or dressed. Many would have originally been heather-thatched but this has been replaced by local slate and, more commonly, Welsh slate when the railway reached Coquetdale. Most buildings date from or were extensively remodelled in the early-to-mid 19th century, as in the Cheviot Fringe and the North Northumberland Coastal Plain but in strong contrast to Mid Northumberland where earlier piecemeal enclosure and buildings are more common.

Only 22 per cent of the NCA is publicly accessible but 15 per cent is covered by the Northumberland National Park; visitors are attracted by the wild, semi-natural landscapes, extensive cultural heritage, recreational opportunities and tranquillity. A small part of the area covered by the National Park falls within the Otterburn Military Training Area and access is therefore restricted. The St Cuthbert's Way and St Oswald's Way long-distance routes and the Pennine Cycleway (Reivers Cycle Route) pass through this area, the extensive forests within the Forestry Commission estate provide recreational opportunities including walking, biking and horse riding, and the exposed crags are popular with climbers.

The sparse settlement, scarcity of major roads and low development pressure have historically contributed to the dark night skies and the perception that this is a tranquil area with little urban disturbance. There are, however, increasing development pressures and a number of wind farms and other vertical structures are now prominent in the landscape and visible from the Cheviot Hills and the coast.

Isolated farmsteads and hamlets are served by the market town of Alnwick and smaller service centre of Rothbury (pictured here). Buildings are traditionally constructed from locally quarried sandstone with slate roofs.

The landscape through time

The Fell Sandstone that gives rise to these distinctive hills is a thick sequence of sandstones deposited in a series of mainly south-east flowing rivers during Carboniferous times, about 300 million years ago. These coarse-grained sandstones contain abundant evidence of their mode of deposition in the form of inclined bedding planes which are especially conspicuous on weathered surfaces.

Carboniferous Limestone, deposited in tropical seas, forms the lower-lying land towards the south and east of the area. Large areas of the bedrock geology are covered by thick layers of glacial till with small areas of sands and gravels around existing rivers.

The Fell Sandstone dips gently towards the east and south-east. Erosion of the weaker rocks has produced the highly distinctive series of bold 'cuesta' landforms of which the Simonside Hills and Harbottle Crags are fine examples. The underlying geology weathers slowly to produce thin, sandy, acidic soils.

For centuries the moorlands, many of which were cleared in the Neolithic and Bronze Age to provide grazing land, have been used by the surrounding communities for summer grazing, with heather and bracken cut for fuel, bedding, roofing and fodder. Extensive prehistoric settlement and ritual remains are concentrated in the moors, together forming some of the most interesting archaeological landscapes in England. There are Neolithic standing stones and burial cairns, 'cup and ring' marked rocks, and bronze-age burial and field clearance cairns. Later prehistoric features include a number of iron-age hill forts, enclosed farmsteads, shielings and upland grazing pastures, the more accessible of which developed as farmsteads in the medieval period.

These 'cup and ring' marked rocks are just some of the many prehistoric and medieval archaeological and built heritage assets which are scattered across this area, together forming some of the most interesting archaeological landscapes in England.

Evidence of the Roman occupation can be seen in the form of the marching camps and forts associated with Dere Street (A68) to the south and the Devil's Causeway to the north of the NCA.

Village-based settlements and the market towns of Rothbury and Alnwick were established by the 12th century. The area was dominated by arable cultivation in the 12th to 14th centuries, and the summits and upper slopes were used as hunting chase and common pasture with some emparkment for deer such as above Rothbury and at Billsmoor Park, and land above Chillingham became cattle park.

The surviving remains from the medieval period, which include deserted villages, individual settlements and ridge-and-furrow cultivation patterns, still make an important contribution to the character of the hills today. They suggest a period of greater population before the border conflict, raids, famines and epidemics of the 13th century onwards drove people from the area and led to the building of towers or 'peels', defensible bastles and castles such as Alnwick Castle. Mixed farming with an emphasis on rearing cattle and sheep for their meat and wool became prevalent. The Union of the Crowns in 1603 paved the way for more settled conditions although the rieving (raiding) continued well into the next century; there was an increase in the droving of cattle from Scotland and improvements in pasture and arable production by estates, which often continued to build bastles to attract tenants into the area.

There was localised industrial activity from the medieval period onwards such as iron working, coal mining and water milling, particularly in the Grasslees Valley and in the fringe farmland in the south of the NCA. Parts of the Fell Sandstone, especially the pale-pink Doddington Stone and sandstone outcrops in the south, have long been worked as building stone for use both within and outside the area and some workings are still active today.

With the exception of earlier bastles and tower houses, the present pattern of dispersed settlement with isolated farmsteads and hamlets dates from the large-scale re-organisation of the countryside in the late 18th and 19th centuries which was driven by the large estates and associated with agricultural improvement. The Parliamentary enclosure of communal townfields and common pasture on the hills resulted in large fields defined by drystone walls which remain as features of today's landscape. Country houses and castles, such as Chillingham, Cragside and Alnwick Castle, with extensive estates and designed parkland were built or significantly embellished, many sustained by industrial wealth in the later 18th and 19th centuries.

The 19th century also saw the development of the railway network across Northumberland with the Alnwick to Cornhill and Morpeth to Rothbury lines passing through this NCA. Both have now closed but the abandoned lines, stations and bridges are still evident in the landscape.

Many of the estates planted conifer blocks and shelterbelts in the late 19th and early 20th centuries. In the 1920s this area was targeted for its suitability for large-scale commercial conifer planting; plantations such as Harwood and Thrunton woods were established whose geometric shapes still dominate the landscape and which resulted in the drainage and loss of large areas of heather moorland. Reservoirs such as Sweethope Loughs, Fontburn Reservoir and Colt Crag Reservoir were built around the end of the 19th century to provide the wider area with water.

There was further extensive loss of semi-natural habitats from the 1940s onwards, driven initially by the 'plough up' campaigns to quickly increase the amount of land under cultivation following the onset of the Second World War. Large swathes of moorland fringe and grassland, particularly on the dip slopes along the eastern edge of the hills, were ploughed up for arable cultivation, and wetland areas were drained. More recently, agri-environment schemes have begun to reverse this trend, restoring some of the rough pasture.

While the area generally has a low population density with relatively little housing development pressure or industrialisation during the 20th and 21st centuries, the main town of Alnwick continues to expand its housing and employment land provision. Other 20th-century additions to the landscape include the establishment of the Otterburn Military Training Area in the western tip of the NCA resulting in some intrusive features such as roads, security fences, safety notices and overhead power lines, but this has ensured continued extensive management of the moorland. Other features include the Royal Air Force's 'golf ball' radar at Brizlee Wood, Second World War anti-invasion defences including pillboxes along the Coquet Valley, the establishment of a number of caravan parks, and the introduction of numerous vertical structures including radio and television transmitter masts, electricity pylons and mobile phone masts. Several wind farms have been built and are prominent in the landscape. Sand and gravel were extracted at Caistron in the Coquet Valley until 2012 and restoration of the former workings is creating a mosaic of wetland habitats.

The Northumberland Sandstone Hills provide panoramic views of the coast and Cheviots but vertical structures such as wind turbines and communications masts are becoming increasingly prominent along the distinctive skyline.

Ecosystem services

The Northumberland Sandstone Hills 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 Northumberland Sandstone Hills NCA is contained in the 'Analysis' section of this document.

Provisioning services (food, fibre and water supply)

- **Food provision**: The area is important for rearing hardy livestock: 232,400 sheep and 24,400 store cattle are extensively grazed on the upland pasture and moorland. Locally sourced food has the potential to play an important role in supporting tourism in the area and to help to encourage a locally sustainable green economy.

- **Timber provision**: Coniferous woodland covers at least 10,217 ha. There are a number of commercial plantations in this NCA, three of which have been designated as red squirrel reserves. Future demands for timber provision must be balanced against the opportunities for reducing the visual impact of the plantations on the landscape and for large-scale restoration of open moorland habitats, as well as the continued provision of red squirrel reserves. Management of small, broadleaved woodlands and plantations could increase the provision of wood fuel. It will be important to manage woodlands in such a way that they can provide other ecosystem services besides timber production, including benefits to biodiversity, and opportunities for improved access to support recreational activities.

- **Water availability:** The rivers Till and Aln predominantly provide water for crop irrigation while the rivers Coquet, Font and Wansbeck and the Fell Sandstone Aquifer provide public water supply for much of northern Northumberland. Many isolated properties are not connected to mains water and rely on springs or boreholes for their water supply. The Aln, Coquet and Wansbeck have 'water available', the Font has 'limited water available', and the Till (part of the Tweed SAC) is already consented up to the sustainable level for summer abstractions. The Fell Sandstone Aquifer has 'no water available' and there are concerns that there may be insufficient groundwater to meet demand in the future.

- **Genetic diversity**: Chillingham wild cattle are still found in the enclosed park at Chillingham Castle. It is one of only two herds of wild white cattle in the UK, and has been genetically isolated for hundreds of years. The Sandstone Hills are important for rearing hardy local breeds of sheep and cattle. Encouraging the promotion and development of supply chains and markets for high-quality local produce from traditional breeds has the potential to develop a green economy that supports local tourism.

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

- **Climate regulation:** Peaty soils which have a high carbon content cover 37 per cent of the area. Sensitive land management and restoration of the overlying habitats should help to reduce the scale of stored carbon being released into the atmosphere and could restore some of the carbon storage capacity and sequestration ability of the peat soils. Extending woodland cover will also improve carbon capture.

- **Regulating soil erosion:** The peaty soils of this NCA are prone to water and wind erosion but currently good vegetative cover reduces the risk of this. Soils on the scarp and dip slopes, particularly freely draining acid loamy and sandy soils, are very vulnerable to erosion, predominantly by water, and this is currently a significant issue. Soil erosion and sediment run-off to watercourses could be diminished by reducing the intensity and frequency of arable cultivation of these vulnerable soils. Good moorland and forestry management is also important, particularly at times of heather burning, harvesting and replanting, when fragile soils may become exposed.

- **Regulating water quality:** Ecological river water quality is generally good or moderate but chemical quality of groundwater is poor across most of the NCA, including in the Fell Sandstone Aquifer where elevated levels of nitrate, sulphate, potassium and volatile compounds have been detected. There are some issues of diffuse pollution from agriculture, particularly soil and nutrient run-off, and some contamination of groundwater from localised industrial and mine water discharges and non-mains and mains drainage and sewerage.

- **Regulating water flow:** The steep headwaters of the Coquet drain the Cheviots and respond quickly to rainfall, leading to a rapid onset of flooding. Rothbury is the main settlement at risk of flooding in this NCA but there are others such as Felton and Warkworth in downstream NCAs. While there is little risk of flooding of property along the Wansbeck in this NCA, there is significant risk downstream around Morpeth. Flooding is a risk along the length of the River Aln but damage has been limited to bridges and agricultural land within this rural NCA. The preferred approach to managing this flood risk both in this and in downstream NCAs includes promotion of sustainable land management practices that reduce the amount and rate of run-off and erosion, new woodland planting along riparian zones, and investigation of measures such as floodwater storage in gravel pits upstream of Rothbury and in designated areas on the Wansbeck.

Cultural services (inspiration, education and wellbeing)

- **Sense of place/inspiration:** The distinctive skyline of rugged moors with craggy outcrops, dramatic skies and panoramic views contrasts with the wooded valleys, designed parklands and pastures of the lower slopes and valleys, creating a strong sense of place that is valued by local people and visitors.

- **Sense of history:** The Northumberland Sandstone Hills contain a variety of prehistoric sites which together form some of the most interesting and nationally important archaeological landscapes in England. These prehistoric remains combined with the later historic features from the medieval period and large-scale re-organisation of the 18th and 19th centuries contribute much to the sense of history and provide opportunities to explore the connections between the geology, the history of man's activities and today's landscape.

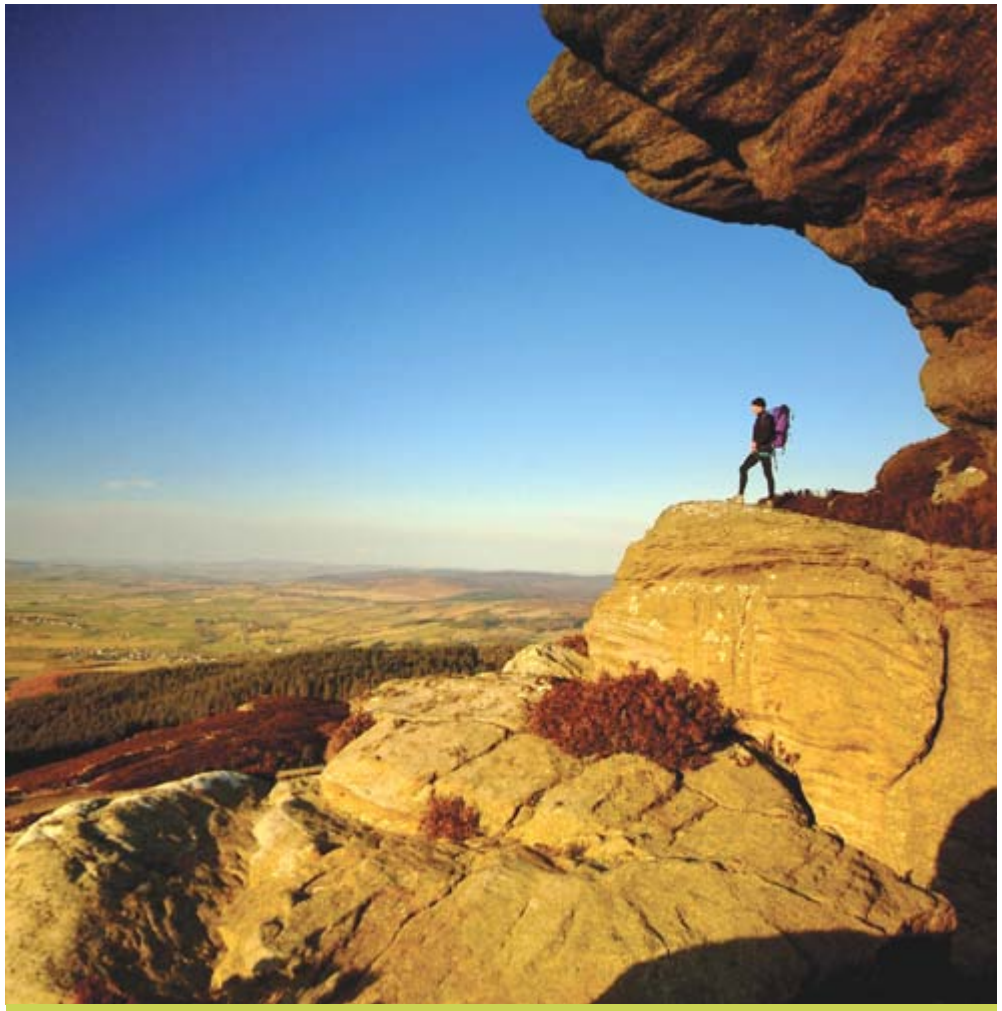
- **Tranquillity:** The open moorlands, sheltered valleys, woodlands and parklands, sparse settlement, scarcity of major roads, low development pressure and dark night skies have contributed to the perception that this is a tranquil area with little urban disturbance. Opportunities exist to promote the calming and restorative effect of this environment on visitors' health and wellbeing. Development, particularly wind farms,

forestry operations, light sources and intrusion from the Otterburn Military Training Area need to be controlled to maintain the tranquillity and dark night skies that are so highly valued by locals and visitors alike.

- **Recreation:** The network of public rights of way, long-distance routes, extensive open access land, craggy outcrops, rivers, forests and a variety of tourist attractions provide a number of opportunities for activities such as walking, biking, horse riding, climbing and fishing, and enable locals and visitors to explore and appreciate the tranquil landscapes and wealth of biodiversity, geodiversity and heritage assets in this NCA.

- **Biodiversity:** This NCA contains a mosaic of extensive and varied semi-natural habitats of high biodiversity value including wet and dry heathland, mires, blanket bog, calcareous and acid grasslands, meadows, woodland, rivers and riparian habitats, with key areas designated as SSSI, SAC, SPA and Ramsar. These habitats support important assemblages of invertebrates, amphibians, mammals and birds including iconic species such as hen harrier, peregrine, merlin, curlew and red squirrel which are a key attraction for visitors.

- **Geodiversity:** The distinctive skylines and iconic landforms of the Fell Sandstone, combined with prehistoric features such as rock art, historic quarries and sandstone buildings, are key to the strong sense of place in this NCA. The distinctive geology provides important opportunities for research and education to enhance understanding of geological and fluvial processes. There are a number of small-scale sandstone quarries which are still in operation and sand and gravel were extracted at Caistron in the Coquet Valley until 2012.



The craggy outcrops around Harbottle and Simonside are distinctive features of the area and are very popular with climbers visiting this part of the Northumberland National Park.

Statements of Environmental Opportunity

SEO 1: Conserve, restore and significantly expand the moorlands, for the habitats, the strong sense of tranquillity and landscape character, and recreational opportunities that they provide. Reduce the visual impact of conifer plantations and enhance their biodiversity value, ensuring that the moorland habitats provide a well-functioning ecosystem that will be more resilient to climate change, will continue to support nationally and internationally important species of wildlife, and will facilitate groundwater recharge of the Fell Sandstone Aquifer, while enhancing their ability to store and sequester carbon and regulate water quality and flow.

For example, by:

- Securing sustainable grazing and heather burning regimes and promoting upland grazing by hardy breeds of cattle to ensure good vegetative cover, structure and composition. This will help to conserve the important habitats and species, maintain soil and water quality, regulate water flow, reduce soil erosion, maintain carbon storage and promote sequestration, while continuing to support livestock farming and grouse shooting.
- Conserving and restoring blanket bog, mires and wet flushes, allowing grips and drains to in-fill naturally and blocking where necessary to re-vegetate bare areas, encourage the establishment of Sphagnum to achieve a healthy and functioning peat bog and promote active peat formation. This should improve their capacity to store carbon and water, thereby helping to regulate water quality and flow and contributing to climate regulation.
- Ensuring that there is a mature heather component to the moorland mosaic to encourage breeding hen harriers, and minimising disturbance during the breeding season by undertaking ground work or management in or adjacent to breeding sites between September and February.
- Seeking opportunities for large-scale restoration of heathland, preferably contiguous to existing areas of moorland habitats, through removal of conifer blocks where this is consistent with the Government's Open Habitats Policy and where this can be achieved while sustaining the level of timber production from the area as a whole. This may involve compensatory planting of well-designed and well-sited woodland.
- Where plantations are to be retained, encouraging their restructuring, softening outlines to integrate them better with the local topography, increasing the amount of open space and structural diversity and adding to the broadleaved component using species suited to the acid ground conditions of the Sandstone Hills, all consistent with the UK Forestry Standard. Continuing to manage designated reserves (Kyloe, Harwood and Raylees) and buffering areas for red squirrels, and ensuring that there is suitable habitat for nightjar.
- Taking opportunities provided by the restructuring of conifer plantations to remove trees from areas of deep peat, blanket bog, mire and wet heath.
- Controlling the spread of bracken and rhododendron where required.
- Preventing and responding quickly to uncontrolled wildfires through a collaborative fire control plan.

SEO 1 continued on next page

SEO 1 continued from previous page

- Maintaining and enhancing the cover and condition of semi-natural habitats to improve infiltration and recharge of the Fell Sandstone Aquifer.
- Encouraging and managing responsible recreational use of the moorlands such as walking, horse riding, mountain biking, climbing and wildlife watching, and increasing recreational provision within the forests to increase understanding and enjoyment of the countryside while minimising soil erosion, damage to archaeology and heritage assets, disturbance of wildlife and the risk of wildfires, and protecting the sense of tranquillity.
- Minimising damage to semi-natural habitats and preserving the open vistas, sense of tranquillity and dark night skies by carefully considering the impacts of any proposed built structures and tracks on the landscape and experiential qualities. Vertical structures could detract from the distinctive skyline of this National Character Area (NCA) and impact significantly on the long, open views.

Cragside Estate

SEO 2: Manage and enhance the farmed environment, providing a mosaic of grassland types and structures to benefit wildlife such as breeding waders and hen harrier, supporting the long tradition of rearing hardy livestock in this area, including preserving the rare breed of Chillingham wild cattle, strengthening landscape character, contributing to food provision and managing cropped areas to minimise soil erosion.

For example, by:

- Supporting the historic tradition of rearing hardy livestock in this area through the production of traditional food products such as lamb, mutton, beef and game, using methods that sustain a healthy moorland environment and marketing them with reference to the special landscapes that their production helps to maintain.
- Maintaining and expanding the herd of Chillingham wild cattle, and providing information and interpretation to improve understanding of their historic and genetic interest.
- Managing grazing levels of rough grazing and pasture to provide a mosaic of grassland types and structure including rushy pasture to provide feeding, roosting and breeding sites for birds including hen harrier, and managing these extensively to minimise disturbance.
- Encouraging extensive grazing with low input of fertilisers, and applying manure in preference to artificial fertilisers where possible, to encourage the build-up of organic material and reduce the effects of compaction and poaching, thus improving infiltration of rainwater.
- Restoring traditional pasture and protecting vulnerable sandy soils on slopes by encouraging reversion from arable where possible.
- Restricting stock access to watercourses, providing troughs or other watering points to avoid trampling and poaching of banks and thus sedimentation of the water.
- Reducing erosion of vulnerable sandy soils, particularly on cultivated slopes, through encouraging the careful timing of mechanised activities, the use of low ground pressure tyres, promoting the use of in-field margins and headlands and planting winter cover crops. In some cases consider land-use change to woodland, consistent with the Environment Agency and Forestry Commission Woodland for Water project.
- Promoting good nutrient and pesticide management including improving farm infrastructure and waste management, carefully managing stock movements and controlling riparian grazing, and informed infield nutrient application.
- Enhancing the biodiversity interest of the arable component of the lower-lying land to the north and along the fringes of the area by encouraging measures to support farmland birds and pollinators such as sowing wild bird seed and nectar flower mixes, cereal headlands and overwintered stubbles.
- Restoring or reinstating hedgerows in the valley bottoms to slow water flow, aid infiltration, improve habitat connectivity and strengthen landscape character.
- Planting early-flowering species such as goat willow to aid pollinators early in the season.

SEO 3: Enhance the connecting corridors of streams, rivers and waterbodies, expanding and linking fragmented habitats such as wet pastures, meadows and native woodland, improving water quality, restoring natural river morphology, promoting natural flood management and exploring the possibility of establishing flood storage areas. This should help to protect nationally and internationally important species, ensure that the rivers and waterbodies retain their reputation as renowned game fisheries, and help to reduce the risk of settlements flooding in this and downstream NCAs.

For example, by:

- Managing and enhancing the patchwork of wet pastures and herb-rich grasslands on lower slopes and valley floors, encouraging extensive livestock systems with low or no input of fertilisers, blocking drains to restore wet pastures where appropriate, creating a mosaic of grassland types and structure that will provide feeding, roosting and breeding sites for birds and restoring flood plain where appropriate.
- Managing, expanding and connecting the fragmented woodland and scrub along river corridors and in the flood plain of the Coquet, creating more ecologically robust habitat networks, re-establishing important wildlife corridors, strengthening the character of these key landscape features, improving water infiltration, stabilising banks, reducing soil erosion and slowing water flow to alleviate flooding of settlements downstream.
- Managing stock grazing levels by fencing where necessary and controlling invasive species such as rhododendron and bracken to encourage natural regeneration of semi-natural woodland and gorse scrub, particularly on wooded bluffs and along burns, in order to diversify age structure and retain the characteristic pattern of the woodlands. This will also help to stabilise banks, reduce soil erosion and regulate water flow.
- Encouraging natural regeneration of stands of juniper scrub by excluding stock and controlling rhododendron, supplemented by planting juniper of local provenance.
- Encouraging the re-coppicing of areas of alder woodland, particularly in the Grasslees Valley where this management regime was historically significant, to encourage longevity of the woodland and increase age structure.
- Preserving and restoring natural fluvial processes and morphology, recognising the importance of the dynamic nature of the rivers which provides the wildlife and landscape interest, and removing structures that form obstacles to the passage of salmon, sea and brown trout and lamprey.
- Seeking opportunities to reduce pollution from industrial and mine water discharges and mains and non-mains drainage and sewerage to benefit watercourses and the Fell Sandstone Aquifer.
- Investigating the possibility of creating flood storage areas, for example on the River Wansbeck and on the Coquet (in gravel pits upstream of Rothbury). Consideration must be given to the impacts on nationally and internationally important species such as white-clawed crayfish and salmon.
- Carefully considering the impacts of any future extraction of sand and gravel from the valley floor on river morphology, water quality and landscape character.

SEO 3 continued on next page

SEO 3 continued from previous page

- Improving sustainable use of water and sympathetic land management practices such as crop selection and water harvesting, and including water conservation measures in new development to counteract increasing demand for water and therefore reduce abstraction pressures on the rivers and groundwater in this NCA.
- Promoting the use of margins and buffers adjacent to watercourses to reduce the impact of arable cultivation and intensive grazing on water quality.
- Continuing to monitor the spread of non-native invasive species such as Himalayan balsam, Japanese knotweed and signal crayfish and controlling this where appropriate and feasible.
- Ensuring that populations of the European Protected and Biodiversity Action Plan species found in the rivers and streams such as otter, brook and river lamprey, Atlantic salmon and water crowfoot are maintained and increased by improving water quality, controlling non-native invasive species and enhancing riparian habitats.
- Ensuring that the streams, rivers, reservoirs and loughs continue to support high-quality angling, and exploring opportunities to enhance the amenity provided by the watercourses, waterbodies and valleys for other recreational pursuits such as wildlife watching, encouraging quiet enjoyment of these resources without detriment to the features and habitats.

Loughs and small reservoirs are scattered throughout the area, often fringed with broadleaved woodland.

SEO 4: Protect, manage and conserve the area's distinctive historic and geological environment with its wealth of archaeological and built heritage assets from 'cup and ring' marked rocks to Alnwick Castle, and the distinctive geological features including the iconic Simonside crags, providing access to these valuable resources and encouraging their use in research and education to improve understanding and enjoyment of the landscape and its cultural development.

For example, by:

- Conserving and interpreting the historic landscapes which often contain evidence of multi-period occupation, recognising the exceptionally high potential in this area for identifying further archaeological evidence of settlement and use, and encouraging further research to identify these.
- Continuing to promote access to and interpretation of the iconic landmarks such as Alnwick Castle and the 'cup and ring' marked stones which contribute greatly to sense of history and place.
- Encouraging sympathetic land management and use to protect the wealth of archaeological ground features from damage, in particular ensuring that farming and forestry operations do not cause damage and recognise the potential for as yet undiscovered archaeology, controlling encroachment by bracken and scrub and damage by burrowing rabbits, and reducing grazing pressures.
- Managing, conserving and restoring the parklands associated with large estates such as Alnwick Castle, Cragside and Chillingham with its iconic herd of wild cattle, which are key components of the landscape, providing valuable habitat and acting as important tourist attractions.
- Encouraging the maintenance and restoration of drystone walls to preserve the historic field patterns which are a mixture of medieval piecemeal enclosure and regular enclosure from the 18th and 19th centuries, and discouraging the proliferation of post-and-wire fencing which may lead to a loss of enclosure pattern.
- Encouraging the maintenance and restoration of Scheduled Monuments, historic buildings and traditional farm buildings using locally quarried sandstone (with slate roofs for buildings) and local building styles where possible, and ensuring that new and re-developments respect the historic settlement patterns and reflect the local farmstead vernacular in terms of building materials, scale and location. This will help the local economy by providing a market for local stone and developing locally based skills.
- Preserving and enhancing the historic settlement pattern of isolated farmsteads, hamlets and small villages served by the main town of Alnwick and smaller service centre of Rothbury, and ensuring that development in these and other valley settlements remains contained and does not adversely impact upon open countryside.
- Identifying and protecting geological features, such as the Harbottle and Simonside sandstone crags which are popular with climbers, and the many small sandstone quarries, recording geological sections and collecting representative specimens to further knowledge and understanding of the local geology, and encouraging the designation of Local Geological Sites.
- Seeking opportunities to improve access to key historic and geological features, particularly where they act as local focal points and reinforce local distinctiveness, and providing imaginative and clear interpretation to enhance the public's enjoyment and understanding of the area while managing this sympathetically to avoid erosion or disturbance of wildlife.

Supporting document 1: Key facts and data

Northumberland Sandstone Hills National Character Area (NCA): 72,694 ha

1. Landscape and nature conservation designations

The Northumberland Sandstone Hills NCA contains 10,683 ha of the Northumberland National Park covering 15 per cent of the total NCA area.

- The management plan for the protected landscape can be found at: **www.northumberlandnationalpark.org.uk/**

Source: Natural England (2011)

1.1 Designated nature conservation sites

The NCA includes the following statutory nature conservation designations:

Tier	Designation	Designated site(s)	Area (ha)	% of NCA
International	n/a (Ramsar)	Holburn Lake and Moss	28	<1
European	Special Protection Area (SPA)	Holburn Lake and Moss SPA	28	<1
	Special Area of Conservation (SAC)	Simonside Hills SAC; Harbottle Moors SAC; River Tweed SAC	2,881	4
National	National Nature Reserve (NNR)	n/a	0	0
National	Site of Special Scientific Interest (SSSI)	A total of 18 sites wholly or partly within the NCA	7,158	10

Source: Natural England (2011)

Please note: Designated areas may overlap.

There are 36 Local sites in Northumberland Sandstone Hills NCA covering 6,977 ha which is 10 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	4	<1
Favourable	459	6
Unfavourable no change	115	2
Unfavourable recovering	6,580	92

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 within the Northumberland Sandstone Hills NCA varies from a lowest point of 23 m above sea level to a maximum elevation of 435 m. These prominent hills generally reduce in height towards the north, from the Simonside Hills (229 m) and the Harbottle Hills in the south, northwards to include Alnwick Moor, Chillingham Ridge, the Doddington Moors and Doddington North Moor-Ford Moss, which lies at 179 m.

Source: Natural England 2010

2.2 Landform and process

The Northumberland Sandstone Hills form a distinctive skyline feature characterised by generally level tops, north-west facing scarp slopes, and craggy outcrops. They are formed of the Carboniferous Fell Sandstone. They curve across central Northumberland, forming an interrupted line of ridges which is pierced by a number of rivers and streams, including Grasslees Burn and the rivers Coquet and Aln.

Source: Northumberland Sandstone Hills Countryside Character Description

2.3 Bedrock geology

The bedrock geology of the Northumberland Sandstone Hills is a mixture of sandstone and limestone. The Fell Sandstone is a thick sequence of sandstones deposited in a series of mainly south-east flowing rivers during Carboniferous times, about 300 million years ago. These coarse-grained sandstones contain abundant evidence of their mode of deposition in the form of inclined bedding planes (cross-bedding) which are especially conspicuous on weathered surfaces. The Fell Sandstone dips gently towards the east and south-east. Erosion of the overlying and underlying relatively weak rocks has produced the highly distinctive series of bold 'cuesta' landforms of which the Simonside Hills and Harbottle Crags are fine examples. The Fell Sandstone outcrop typically carries very acid soils on which heather moor is well developed. Parts of the Fell Sandstone, especially the pale pink Doddington Stone, have long been worked as building stone for use both within and outside the area. Carboniferous age limestone, deposited in tropical seas, forms the lower lying land towards the south and east of the area. The Carboniferous igneous intrusions of the Whin Sill, although not a prominent landscape feature in this NCA, can be seen in some of the disused quarries.

Source: Northumberland Sandstone Hills Countryside Character Description

Natural Area

2.4 Superficial deposits

Large areas of the bedrock geology are covered by thick layers of sediments deposited during the last main glacial period of the Ice Age. Most of these deposits are consist of till and small areas of sands and gravels centred on existing rivers. The NCA contains small areas of peat covering 4 per cent of the NCA area.

Source: Northumberland Sandstone Hills Countryside Character Description

2.5 Designated geological sites

Designation	Number
Geological Site of Special Scientific Interest (SSSI)	4
Mixed interest SSSI	0

Source: Natural England (2011)

There are no Local Geological Sites within the NCA.

- 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

The sandstone bedrock slowly weathers to form thin, acidic, nutrient-poor sandy soils which support dry heather moorland, particularly above 250 m.

Source: Northumberland Sandstone Hills Countryside Character Description

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

Agricultural Land Classification	Area (ha)	% of NCA
Grade 1	0	0
Grade 2	36	<1
Grade 3	15,804	22
Grade 4	17,744	24
Grade 5	31,706	43
Non-agricultural	7,123	10
Urban	281	<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)

3. Key water bodies and catchments

3.1 Major rivers/canals

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

Name	Length (km)
River Aln	16
River Till	15
River Coquet	17
Fallowlees Burn	9
River Font	3
River Rede	3
River Wansbeck	<1

Source: Natural England (2010)

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

3.2 Water quality

The total area of Nitrate Vulnerable Zone is 4,543 ha, 6 per cent of the NCA.

Source: Natural England (2010)

3.3 Water Framework Directive

Maps are available from the Environment Agency showing current and projected future status of water bodies at: http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e

4. Trees and woodlands

4.1 Total woodland cover

The total area of woodland is 14,195 ha, 19.5 per cent of the NCA. Four per cent of this is ancient woodland.

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

4.2 Distribution and size of woodland and trees in the landscape

Woodland cover is significant, a large proportion of which is coniferous plantations within the Forestry Commission estate. Broadleaved woodland is associated with rivers, scarp slopes and the parkland settings of the large country mansions that fringe the lower fellside slopes such as Chillingham, Cragside and Alnwick Castle.

Source: Countryside Quality Counts 2003

4.3 Woodland types

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

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

Woodland type	Area (ha)	% of NCA
Broadleaved	1,749	2
Coniferous	10,217	14
Mixed	391	<1
Other	1,838	2

Source: Forestry Commission (2011)

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

Type	Area (ha)	% of NCA
Ancient semi-natural woodland	276	<1
Ancient re-planted woodland (PAWS)	287	<1

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

Field boundaries comprise drystone walls. Sandstone rubble walls are characteristic of the late 18th and early 19th century enclosure, with hedgerows in valley bottoms.

Source: Northumberland Sandstone Hills Countryside Character Area description; Countryside Quality Counts (2003)

5.2 Field patterns

Farmland comprises a mixture of piecemeal strip fields from the medieval period and large, rectangular fields dating from the time of the parliamentary enclosures (principally late 18th and 19th centuries), bounded by drystone walls and often subdivided by more recent post and wire fencing. However, blocks and belts of coniferous woodland interrupt the pattern.

Source: Northumberland Sandstone Hills Countryside Character Area description; Countryside Quality Counts (2003); Northumberland Sandstone Hills National Character Area 2 Farmstead and Landscape Statement (draft, 2013)

6. Agriculture

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

6.1 Farm type

In 2009, 233 commercial holdings were registered within the Northumberland Sandstone Hills NCA, down from 254 in 2000. These farms were predominantly livestock holdings (64 per cent) with 26 mixed (11 per cent), 20 arable (9 per cent) and 31 other types of holding (13 per cent) making up the remainder.

Source: Agricultural Census, Defra (2010)

6.2 Farm size

Approximately half of the commercial holdings within the NCA are over 100 ha, and these account for 93 per cent of the farmed area. Less than a third are under 50 ha in size. Between 2000 and 2009 there was a slight reduction in the number of holdings over 100 ha and a slight increase in the number between 2 and 50 ha in size.

Source: Agricultural Census, Defra (2010)

Belted Galloway cattle.

6.3 Farm ownership

2009: Total farm area = 57,927 ha; owned land = 21,600 ha
2000: Total farm area = 57,793 ha; owned land = 19,134 ha

Source: Agricultural Census, Defra (2010)

6.4 Land use

Grass and uncropped land made up 89 per cent of land use within the NCA in 2009, up from 84 per cent in 2000. Area under cereals reduced during this period from 10 to 7 per cent.

Source: Agricultural Census, Defra (2010)

6.5 Livestock numbers

Sheep are the dominant livestock type within the Northumberland Sandstone Hills NCA. In 2009 there were 232,400 sheep recorded within the NCA and 24,400 cattle. However, between 2000 and 2009 both cattle and sheep numbers decreased, by 32 per cent and 26 per cent respectively.

Source: Agricultural Census, Defra (2010)

6.6 Farm labour

In 2009 there were 375 principal managers within the NCA, down from 412 in 2000. During this period the number of full time workers almost halved. Census figures do not indicate that this has been picked up by an increase in part time or gang labour.

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

Simonside Hills SSSI and Bewick and Beanley Moors SSSI, which cover extensive areas, have some fine examples of heathland vegetation and include several rare and important species. In damper areas of 'flush' and mires, heather combines with purple moorgrass and bog myrtle. These mires are important examples of sphagnum bog, exhibiting some of the characteristics of species composition found in the Border Mires.

Source: Northumberland Sandstone Hills Natural Area Profile; Northumberland Sandstone Hills, Countryside Character Area Description

7.2 Priority habitats

The Government's new strategy for biodiversity in England, Biodiversity 2020, replaces the previous Biodiversity Action Plan (BAP) led approach. Priority habitats and species are identified in Biodiversity 2020, but references to BAP priority habitats and species, and previous national targets have been removed. Biodiversity Action Plans remain a useful source of guidance and information. More information about Biodiversity 2020 can be found at; http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/protectandmanage/englandsbiodiversitystrategy2011.aspx

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

Priority habitat	Area (ha)	% of NCA
Upland heathland	12,251	17
Broadleaved mixed and yew woodland (Broad habitat)	684	1
Blanket bog	348	<1
Lowland raised bog	54	<1
Upland calcareous grassland	45	<1
Fens	35	<1
Reedbeds	24	<1
Lowland calcareous grassland	7	<1
Lowland meadows	4	<1
Purple moor grass and rush pasture	1	<1

Source: Natural England (2011)

Maps showing locations of priority habitats are available at

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

7.3 Key species and assemblages of species

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

8. Settlement and development patterns

8.1 Settlement pattern

The Northumberland Sandstone Hills NCA is not densely settled. Settlements show a scattered pattern of isolated farmsteads hamlets and market towns.

Source: Northumberland Sandstone Hills Countryside Character Area description; Countryside Quality Counts (2003)

8.2 Main settlements

The main settlements within the Northumberland Sandstone Hills are Alnwick and Rothbury. The total estimated population for this NCA (derived from ONS 2001 census data) is: 15,885.

Source: Northumberland Sandstone Hills Countryside Character Area description; Countryside Quality Counts (2003), Natural England (2012)

8.3 Local vernacular and building materials

Local sandstone, with red pantiles or grey slate (Scottish, Cumbrian and later Welsh) roofs, is the predominant building material.

Source: Northumberland Sandstone Hills Countryside Character Area description; Countryside Quality Counts (2003)

9. Key historic sites and features

9.1 Origin of historic features

Early settlement and activity is evident in the Neolithic and bronze-age remains visible in the landscape, including standing stones, cup-and-ring marked stones, burial mounds and cairns. The area contains one of the most important concentrations of prehistoric remains in England.

Later bronze-age and iron-age settlement is indicated by distribution of hillforts and other enclosures mainly along the transitional slopes.

Earthwork remains of villages and hamlets suggest that medieval settlement - subject to shrinkage and desertion from the 14th century - was quite extensive. Elsewhere within the hills the medieval and later settlement pattern is characterised by isolated farmsteads and small hamlets served by market towns of Rothbury and Alnwick.

Small nucleated settlements with associated townfields replaced earlier dispersed patterns. Planned settlements with 2 regular rows of house plots, tofts or garths, facing each other across roads or greens.

Large estates have been a major influence. Country houses (mainly with earlier fortified caves) and castles with extensive estates and parkland lie on the lower slopes. Extensive reorganisation of the medieval landscape driven by large estates in the 18th and 19th centuries resulted in intensive grain cultivation, cattle rearing and fattening, dairying for local and distant markets and much more wide scale sheep farming.

Sandstone quarries of many periods, mostly disused, are scattered throughout the hills.

The lower slopes and valleys to the south and east retain traces of medieval open-field agriculture (ridge and furrow cultivation) related to areas of formerly more extensive settlement.

Second World War anti-invasion defences (such as pillboxes) occur along the Coquet Valley.

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

9.2 Designated historic assets

This NCA has the following historic designations:

- 3 Registered Parks and Gardens covering 2,170 ha
- 0 Registered Battlefield/s covering 0 ha
- 225 Scheduled Monuments
- 735 Listed Buildings

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

- 22 per cent of the NCA (15,997 ha) is classified as being publically accessible.
- There are 698 km of Public Rights of Way at a density of 1 km per km2.
- There are no National Trails within the Northumberland Sandstone Hills NCA but the St Cuthbert's Way long distance route passes across the north of the NCA and St Oswald's through the southern half.

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)	8	<1
Common land	2	<1
Country parks	406	<1
CROW Access Land (Section 4 and 16)	15,997	22
CROW Section 15	2,839	4
Village greens	22	<1
Doorstep greens	0	0
Forestry Commission Walkers Welcome Grants	44	<1
Local Nature Reserves (LNR)	9	<1
Millennium greens	0	0
Accessible National Nature Reserves (NNR)	0	0
Agri-environment Scheme Access	80	<1
Woods for People	3,952	5

Sources: Natural England (2011)

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

11. Experiential qualities

11.1 Tranquillity

Based on the CPRE map of Tranquillity (2006) the highest areas of tranquillity occur towards the centre of the NCA around Harwood Forest, the lowest values are associated with the principal road network of the A1, A68, A696 and A697, and Alnwick. As can be seen from the mean value below the majority of the area experiences relatively high levels of tranquillity.

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

Category of tranquillity	Score
Highest	141
Lowest	-48
Mean	29

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 intrusion in the NCA is largely associated with the main town of Alnwick and the principal roads. A breakdown of intrusion values for this NCA is detailed in the table below.

Intrusion category	1960s (%)	1990s (%)	2007 (%)	Percentage change (1960s-2007)
Disturbed	2	5	7	5
Undisturbed	98	95	93	-5
Urban	<1	n/a	<1	n/a

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are a small decrease in undisturbed land over the last 50 years. This is particularly notable given the significant decreases seen in the rest of England.

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

Simonside Hills

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)
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- 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)
- 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)
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- 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 per cent. The convention <1 has been used to denote values less than a whole unit.

Supporting document 2: Landscape change

Recent changes and trends

Trees and woodlands

- Between 1999 and 2003 there was some uptake of the Woodland Grant Scheme resulting in restocking of woodlands and expansion of mainly upland oak and some ash woodlands.

- Between 2005 and 2012 Higher Level Stewardship agreements and English Woodland Grant Scheme agreements were set up which included management options to maintain or restore over 300 ha of wood pasture and parkland, maintain or restore over 170 ha of woodland, and create over 100 ha of woodland.

- Invasive rhododendron which has 'escaped' from parklands is progressively dominating the understory of surrounding woodlands.

- A number of the Forestry Commission plantations have reached maturity and are being felled and replanted. There has been some reduction in the impact of conifer plantations on the landscape through restructuring and replanting with deciduous species.

- Three of the large conifer plantations (Kyloe, Harwood and Raylees) have been designated as red squirrel reserves and are being managed with the conservation of this species in mind. Landowners and managers of several of the large estates are now controlling grey squirrels to buffer the red squirrel strongholds.

Boundary features

- The estimated boundary length in the NCA is 5,817 km. Between 1999 and 2003 the total length of boundaries being managed under Countryside Stewardship agreements was equivalent to about 2 per cent of this.

- Uptake of boundary options under Environmental Stewardship (to March 2011) was greater with 175 km of stone walls and 287 km of hedgerows under management but overall there has been a perceived deterioration in the condition of stone walls and hedgerows.

A number of extensive conifer forests interrupt the chain of moorland. Provision of soft wood remains important in this NCA and three of these forests have been designated as red squirrel reserves, but ongoing restructuring, species diversification and removal of forest blocks should lessen the impact on the landscape and increase biodiversity value.

Agriculture

- The majority of holdings are grazing livestock with 89 per cent of land either grass or un-cropped and sheep as the dominant livestock type. Between 2000 and 2009 the number of sheep dropped by 32 per cent (to 232,400) and the number of cattle by 26 per cent (to 24,400). These reductions in numbers may reflect the impact of foot-and-mouth disease and change in subsidies.

- Post- Second World War demand for food led to grass along the fringes, particularly on the dip slopes, being ploughed up for arable cultivation. Reversion of these areas to grass has been a priority through agri-environment schemes over the last 20 years and between 2000 and 2009 the area of grass/un-cropped land increased by 5 per cent and the area cultivated for cereals fell by 3 per cent.

- Historically heather has been burned in large blocks (100–200 ha) for sheep grazing. Agri-environment schemes have been used to support more sustainable burning and grazing regimes which is beginning to restore a mosaic of structure to the upland heathlands. Hot and dry conditions in recent summers have led to the occurrence of severe wildfires such as that at Harbottle in 2007.

- The upper slopes and moorland have historically been grazed by hardy cattle breeds but numbers have dwindled over recent decades. Agri-environment schemes are being used to reintroduce grazing by native rare breeds such as Belted Galloways and Aberdeen Angus to benefit the semi-natural habitats.

Settlement and development

- There has been a slight increase in perceived intrusion from urban development and noise, largely associated with the main town of Alnwick and the principal roads.

- Developments in the Otterburn Military Training Area in response to changes in military training requirements have resulted in the construction of new infrastructure and the use of new weapons systems which may have increased the perceived noise intrusion.

- Increasing numbers of walkers and rock climbers, attracted to the more accessible sandstone rock exposures, such as those at the Kyloe and Simonside Hills, have led to demand for further parking within the countryside and measures to address areas of localised footpath erosion.

- A number of radio and television communication masts and more recently wind farms have been built and are prominent in the landscape, impacting on views from the Cheviots and coast as well as within the NCA. There have been housing, employment and tourism developments in Alnwick and some housing development and a new hospital in Rothbury.

- There has been a marked uptake in renewable energy technology at a local level such as solar panels and micro wind turbines.

Semi-natural habitat

- Increased coverage of acid grassland and invasion by bracken on the moorlands, particularly on deeper soils, has changed the appearance of the landscape. Between 1999 and 2003 there was reasonable uptake of Countryside Stewardship agreements for upland habitats which included considerable bracken control.

- Since 2005 there has been significant uptake of Environmental Stewardship. Much of the permanent grassland is being managed with low inputs or very low inputs, or for waders. Cattle grazing of the upland slopes is being encouraged with over 9,500 ha managed under cattle-grazing or mixed-stocking options (to May 2013). Over 15,600 ha or moorland is under maintenance or restoration options involving sustainable stocking levels and heather burning regimes.

Historic features

- This is an important prehistoric archaeological landscape. Since 2005 there has been a strong uptake of Environmental Stewardship options for historic and landscape features with over 4,800 ha of land being managed for archaeological features by May 2013.

- Parklands are important elements of this landscape and in 1918 about 3.6 per cent of the area was historic parkland but by 1995 it is estimated that 33 per cent of this area had been lost. Much of the remaining parkland is now being managed under agri-environment schemes.

- Only a limited number of traditional farm buildings have been maintained or restored through agri-environment schemes; many of those remaining are unconverted and structurally intact but not under active management.

Rivers

- Increased arable cultivation and livestock rearing over recent decades has contributed to a reduction in riverside woodland and fringing vegetation and subsequent increase in erosion of river banks, particularly on the rivers Till and Coquet.

- Introduced or alien species have expanded along some river reaches, with colonisation by giant hogweed, Himalayan balsam, Japanese knotweed and signal crayfish. There has been a concerted effort recently through the Tweed Invasives Project to control Himalayan balsam and signal crayfish in particular on the Till.

- The water quality in the Fell Sandstone Aquifer has deteriorated due to diffuse pollution from agricultural sources, localised industrial contamination, surface water contamination from mine water discharges and some contribution from non-mains drainage and mains sewer leakage.

Minerals

- A number of stone quarries are still active but these are all relatively small scale. Spoil from abandoned quarries is slowly re-vegetating, reducing the visual impact.

- Sand and gravel extraction at Caistron in the Coquet Valley ceased in 2012. Flooding of this quarry in 2009 caused water quality problems for the Coquet but this is now being addressed, and while the quarry is currently still a very visible scar on the landscape, restoration of the site to ponds and wetlands is already providing considerable biodiversity interest and will reduce the visual impact.

Drivers of change

Climate change

Climate change projections predict more frequent and intense rainfall events and a rise in the rate of temperature increase leading to drier summers and wetter winters in the longer term. This could result in:

- Increased 'flashiness' and volume of flows within all river catchments with potential for more frequent winter flooding and summer drought in this and downstream NCAs, exacerbating issues with over-abstraction, diffuse pollution and sedimentation and possibly leading to eutrophication and increased hydraulic scour.
- Increased need for flood water storage measures, particularly on the Coquet and Wansbeck to reduce flood risk in downstream NCAs.
- Summer droughts drying vulnerable soils such as peat and wetland habitats, causing increased risk and severity of wildfires and oxidisation and loss of peat. This, combined with heavy rainfall events could lead to significant increases in erosion and run-off.
- Species extinction or migration and loss of small or isolated habitats, and continued decline of biodiversity in fragmented habitats such as woodlands. Conditions may begin to favour invasive non-native species.
- Change in overall upland mosaic with loss of heather and shift towards acid grassland, with increasing encroachment by bracken.
- Change in species composition within woodlands and damage to or loss of veteran trees within managed parklands.
- The spread of tree diseases which poses a significant threat to native species such as ash and consequently has landscape-scale implications where species are common in field boundaries and woodlands.
- An increase in drought-resistant species and an increase in frequency and severity of pest attacks. Heat stress and increased parasite load may cause a decline in species such as grouse.
- Scope for new species to be used for crops and timber, but risk of increase in pests and diseases. These will require modification of silviculture systems to adapt to the changing climate, some commercial species becoming less suitable in the future.
- A decline in species such as salmon which are sensitive to thermal stress which would impact on the game fishing industry.
- Possible erosion or loss of access to the significant buried archaeology, built heritage assets and field boundaries from increased winter rainfall, summer drought and encroachment by vegetation.
- An increase in the need for water storage reservoirs on farms for watering stock and crops.

Other key drivers

- The increased understanding of the importance of upland peat soils for carbon storage may see increased resources being put towards protection and restoration of moorland and blanket bogs. This will also protect water quality from issues related to peat degeneration such as increased colour.
- The need to maintain or improve water and habitat quality in the Tweed Catchment Rivers SSSI and SAC and Coquet SSSI, coupled with implementation of the Water Framework Directive and the Wetland Vision initiative, and combined with the need to manage flooding in downstream areas should improve ecological status of the rivers and waterbodies in the area.
- The Natural Environment White Paper (2011) calls for joined-up efforts across the conservation sector and working at a landscape scale, to establish coherent and resilient ecological networks capable of adapting to environmental change and halting losses in biodiversity. An increased focus on connectivity and resilience of habitats should lead to greater networks of habitats, a more diverse mosaic of vegetation, and larger areas of semi-natural habitat.
- The Government's UK Low Carbon Transition Plan (2009), Forestry and Woodlands Policy Statement (2013) and the Regional Forestry Strategy for the North East of England (2005) indicate an increased rate of woodland creation over the next 15–20 years, alongside an increase in demand for timber and wood fuel. A requirement for increasing renewable energy generation could result in increased pressure for wind power, hydro power, wood fuel and biomass crops.
- The Growth and Infrastructure Act 2013 and roll-out of Next Generation Access communications networks may result in increased pressure to install new built structures such as communications masts and lines and new electricity supplies.
- Defra's Uplands Policy Review (March 2011) identifies the need to develop strong partnerships with the hill farming and moorland management sector and rural communities to deliver a wide range of public goods and environmental benefits.
- Increasing demand for food provision and for fodder for stock may result in more pressure to intensify arable production, resulting in the ploughing out grass and fringe moorland, particularly on the dip slopes, which would cause loss of semi-natural habitat, increase the risk of soil erosion and threaten archaeology.
- With improvements to access provision, it is likely that visitor numbers will increase, enabling more people to enjoy the countryside, leading to improvements in their health and wellbeing, and with potential benefits for the local economy. This needs to be sensitively managed to avoid putting unsustainable pressure on habitats and infrastructure, with increased risks of footpath/bridleway erosion, demand for car parks and signage, and damage to vegetation and wildfires all presenting challenges. Opportunities for green tourism and voluntary visitor payback should be explored to ensure maximum benefit for the local environment and economy.
- Training requirements at Otterburn Military Training Area will continue to change which may require additional infrastructure and impact on perceptions of tranquillity.
- The Northumberland Core Strategy identifies Alnwick as one of the main towns in the county and therefore a focus for sustainable new development, and the service centre of Rothbury may also have capacity for sustainable development.

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.

A number of castles such as Alnwick Castle (pictured) and country houses, with extensive estates and designed parklands and gardens lie at the foot of the hills and are popular tourist attractions.

Statement of Environmental Opportunity	Ecosystem Service																	
	Food provision	Timber provision	Water availability	Genetic diversity	Biomass provision	Climate regulation	Regulating water quality	Regulating water flow	Regulating soil quality	Regulating soil erosion	Pollination	Pest regulation	Regulating coastal erosion	Sense of place / Inspiration	Sense of history	Tranquillity	Recreation	Biodiversity	Geodiversity
SEO 1: Conserve, restore and significantly expand the moorlands, for the habitats, the strong sense of tranquillity and landscape character, and recreational opportunities that they provide. Reduce the visual impact of conifer plantations and enhance their biodiversity value, ensuring that the moorland habitats provide a well-functioning ecosystem that will be more resilient to climate change, will continue to support nationally and internationally important species of wildlife, and will facilitate groundwater recharge of the Fell Sandstone Aquifer, while enhancing their ability to store and sequester carbon and regulate water quality and flow.	↗ *	↔ *	↗ **	↔ ***	↔ ***	↗ ***	↗ ***	↗ ***	↗ **	↗ **	↗ **	↗ **	n/a	↑ ***	↗ **	↗ **	↑ **	↑ ***	↗ **
SEO 2: Manage and enhance the farmed environment, providing a mosaic of grassland types and structures to benefit wildlife such as breeding waders and hen harrier, supporting the long tradition of rearing hardy livestock in this area, including preserving the rare breed of Chillingham wild cattle, strengthening landscape character, contributing to food provision and managing cropped areas to minimise soil erosion.	↗ **	↔ **	↗ **	↑ ***	↔ ***	↗ **	↑ **	↗ **	↗ **	↑ ***	↗ **	↗ **	n/a	↗ **	↗ **	↗ **	↗ **	↑ ***	↗ **
SEO 3: Enhance the connecting corridors of streams, rivers and waterbodies, expanding and linking fragmented habitats such as wet pastures, meadows and native woodland, improving water quality, restoring natural river morphology, promoting natural flood management and exploring the possibility of establishing flood storage areas. This should help to protect nationally and internationally important species, ensure that the rivers and waterbodies retain their reputation as renowned game fisheries, and help to reduce the risk of properties flooding in this and downstream NCAs.	↗ *	↔ **	↗ *	↔ ***	↔ ***	↗ *	↑ **	↗ **	↗ **	↗ **	↗ **	↗ **	n/a	↑ **	↗ **	↑ **	↑ **	↑ ***	↗ **
SEO 4: Protect, manage and conserve the area's distinctive historic and geological environment with its wealth of archaeological and built heritage assets from 'cup and ring' marked rocks to Alnwick Castle, and the distinctive geological features including the iconic Simonside crags, providing access to these valuable resources and encouraging their use in research and education to improve understanding and enjoyment of the landscape and its cultural development.	↔ ***	↔ **	↔ **	↗ **	↔ ***	↔ **	↗ *	↗ *	↗ *	↗ **	↔ **	↔ **	n/a	↑ ***	↑ ***	↗ **	↑ ***	↗ **	↑ ***

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

National Importance; Regional Importance; Local Importance

Landscape attributes

Landscape attribute	Justification for selection
Arc of Carboniferous Fell Sandstone forming characteristic ridges with generally flat tops, north-west-facing scarp slopes, and craggy outcrops.	■ Distinctive skyline reaching 440 m which is highly visible from the Cheviot Fringe and the North Northumberland Coastal Plain. ■ Hills provide panoramic views of the Cheviots to the west, the coast to the east and Scotland to the north. ■ The craggy outcrops around Harbottle and Simonside are distinctive features of the area and are very popular with climbers visiting this part of the Northumberland National Park. Other key climbing crags in this NCA include those at Kyloe, Bowden Doors, Great Wanney and Callerhues.
Extensive moorlands supporting a mosaic of wet and dry heath, mires, blanket bog, fens, flushes and acid and calcareous grassland, divided by extensive conifer plantations.	■ Almost 13,500 ha of known priority habitats of which 12,250 ha is upland heathland. ■ Moorland habitats designated for their national and international significance including Holburn Lake and Moss SPA and Ramsar, Simonside Hills SAC, Harbottle Moors SAC and Bewick and Beanley Moors SSSI. ■ These habitats support iconic bird species such as hen harrier, peregrine, merlin, ring ouzel, whinchat, golden plover, dunlin and curlew. ■ The moorlands provide tranquil and inspirational experience, opportunities for appropriate recreation and opportunities to appreciate the wealth of biodiversity, geodiversity and heritage assets of the area.
Rough grazing gives way to semi-improved and improved pastures on the slopes, bounded by dry stone walls in a mixture of piecemeal and regular enclosure but broken by numerous shelter belts and small conifer blocks, with some cropping on lower slopes and valley bottoms.	■ There is a long tradition of rearing hardy sheep and cattle to provide stock for cross-breeding and to sell directly to the meat industry, supporting the local economy and maintaining the semi-natural habitats. ■ The pattern of enclosure contributes to the historical complexity of the landscape, comprising a mixture of medieval strip fields and regular enclosure from the 18th and 19th centuries.
The Aln and Coquet rivers break through the arc of hills, flowing through wide, meandering valleys and providing important water supply for the area.	■ The wide, fertile river valleys of the Aln and Coquet contrast with the thin, nutrient poor soils of the uplands, supporting a patchwork of wet pastures and arable land. ■ The Aln provides water predominantly for crop irrigation and the Coquet, along with the River Wansbeck which arises in the Sandstone Hills, the Fell Sandstone Aquifer and several reservoirs provide public water supply for much of this area of Northumberland. Many isolated properties, however, derive their water supply direct from springs or boreholes. ■ The rivers, reservoirs and loughs scattered throughout the area are renowned game fisheries and provide an important biodiversity resource. ■ The River Till which meanders through the lowlands in the north-western corner of this NCA is part of the Tweed Catchment Rivers SAC designated for species and habitats including Atlantic salmon, brook and river lamprey, otter and water crowfoot. ■ The Coquet, much of which is designated as SSSI for its woodlands and species it supports such as salmon, lamprey and otter is a particularly good example of a highly dynamic and unrestricted river, flowing through the gravel terraces of its flood plain.

Landscape attribute	Justification for selection
Relatively high woodland cover, with broadleaved woodlands predominantly confined to watercourses, scarp slopes and some of the large country estates, large geometric conifer plantations on hill tops and slopes, and smaller shelter belts scattered across lower lying land.	■ Woodland covers 14,195 ha of the NCA (19.5 per cent) of which more than 10,217 ha consist of coniferous plantations (this figure represents mature or nearly mature plantations only and does not include new planting or recently felled areas). ■ Notable areas of ancient semi-natural woodland comprising oak, ash, rowan and birch make an important contribution to character, particularly on steeper slopes below the scarp face and in the steep-sided valleys, and are designated features of a number of SSSI. Remnant alder woodland still lines many of the watercourses. Nationally important relict stands of juniper are found in a few locations such as Bewick and Beanley Moors, Harbottle Moors and Simonside Hills SSSI. ■ Larger areas of deciduous woodland are associated with the country estates. ■ Broadleaved woodlands contribute significantly to perceptions of tranquillity and sense of place. ■ This area plays an important role in the provision of soft wood; there are a number of large conifer plantations. These geometric blocks are often at odds with the natural topography and landscape, and harvesting activity can impact on perceptions of tranquillity and increases the risk of water sedimentation. ■ The woodlands within the Forestry Commission estate provide recreational opportunities including walking, biking, horse riding and wildlife watching. ■ Three of the conifer plantations have been designated as red squirrel reserves.
A wealth of prehistoric and medieval archaeology including 'cup and ring' marked rocks, bronze-age burial cairns, iron-age hillforts, standing stones, deserted medieval villages, shielings, field systems and bastles together form complex, multi-period landscapes.	■ The Northumberland Sandstone Hills provide one of the most important concentrations of prehistoric remains in England with particularly fine examples of 'cup and ring' marked rocks. ■ Iron-age hillforts are distinctive and highly visible features of this area. ■ Evidence of Roman occupation is limited but includes Dere Street, the Devil's Causeway and associated forts and marching camps. ■ Bastles, towers or 'peels' and castles including the iconic Alnwick Castle are reminders of the conflict and raids associated with proximity to the Anglo/Scottish border. ■ Extensive remains from the medieval period take the form of deserted villages, field systems, shielings and enclosures and reinforce the sense that human settlement of the area has changed greatly over time. ■ There are 225 Scheduled Monuments and 735 Listed Buildings.
Castles and country houses including Alnwick Castle, Chillingham and Cragside, with extensive estates and designed parklands and gardens lie at the foot of the hills.	■ Parkland and extensive designed gardens are an important component of the rich and varied landscape of the lower slopes and valleys. ■ Large country houses and castles such as Alnwick Castle, Chillingham and Cragside are popular tourist destinations. The grounds of Alnwick Castle were laid out by Capability Brown and the Castle and Gardens attract large numbers of visitors each year, particularly since the Castle featured as 'Hogwarts' in the Harry Potter films. ■ Chillingham has one of only two herds of a rare breed of wild cattle in the UK which has been genetically isolated in the estate's parkland for hundreds of years. ■ Cragside is famous as the world's first house to be lit by hydroelectric power. ■ There are three Registered Parks and Gardens.

Landscape attribute	Justification for selection
Sparse settlement characterised by scattered isolated farmsteads, often with distinctive tree belts, small hamlets and villages linked by a network of minor roads and served by the market towns of Alnwick and Rothbury.	■ The market towns of Rothbury and Alnwick date from the 12th century and are now thriving tourist centres. ■ Much of the present settlement pattern dates from the large-scale reorganisation of the countryside in the 18th and 19th centuries which was driven by the large estates and associated with agricultural improvement and is nationally important in this context. ■ Sparse settlement and few major roads contribute to perceptions of tranquillity.
Locally quarried sandstone is used in the construction of the dry stone walls and traditional buildings, creating a strong vernacular character and cohesion with the geology of the area.	■ There is a long history of sandstone being quarried for building stone for use within and outside this area. ■ Parliamentary enclosure on the hills and moors resulted in large fields defined by great dry stone walls which remain as features of today's landscape. ■ Construction from locally quarried sandstone gives farmsteads and villages a strong vernacular character which contributes to sense of place. ■ The many abandoned stone quarries are characteristic features of this landscape and provide some of the most important sites at which certain rock units may be seen, contributing greatly to the area's geodiversity. Many also provide significant biodiversity interest. ■ Abandoned stone quarries, along with remains from past iron and coal mining activity provide important historical evidence of the changing use of this landscape.
A varied and distinctive landscape valued for its tranquillity and dark night skies and which provides opportunities for recreation and quiet enjoyment of this high quality environment.	■ Despite disturbance associated with forestry operations, military training and grouse shooting this NCA is perceived to be one of the most tranquil in England and 93 per cent of the area is classified as 'undisturbed'. But it is not yet known what the impacts of the increasing number of wind farms will be on perceptions of tranquillity. ■ The public rights of way network (699 km at a density of just over 1 km per km2), St Cuthbert's Way and St Oswald's Way long-distance routes, Pennine Cycle Way (Reivers Cycle Route) and the significant area of open access land (covering 15,997 ha) enable residents and visitors to access and enjoy the natural assets of the area. ■ Significant opportunities for rock climbing due to the topography and sandstone outcrops. ■ 10,683 ha of the NCA (15 per cent) lies within the Northumberland National Park. ■ Sparse settlement means the night skies are some of the darkest in England and as such the Northumberland National Park Authority applied (in 2013) for International Dark Skies Park status to include part of this NCA.

Landscape opportunities

- Protect, manage and expand the moorland mosaic, retaining and enhancing the diversity of habitats including transitional and fringe habitats, through securing sustainable mixed livestock farming and grouse moor management.
- Restore blanket bog and encourage active peat formation by natural in-filling of drains or grip-blocking where necessary and through careful grazing and heather-burning management to encourage full vegetative cover, improving water and carbon retention and sequestration capacity.
- Manage conifer plantations to 'soften' the impact on the landscape, restructuring to include more open space and rides and increasing the broadleaved component especially along rides and watercourses. Where appropriate, increase access provision and recreational facilities.
- Utilise opportunities presented by the felling of mature conifer plantations to recreate large areas of heathland on the upper slopes and ridgetops, with compensatory broadleaved woodland planting in more suitable locations such as in the valleys and scarp slopes.
- Manage plantations designated as red squirrel reserves with this species in mind, avoiding clear-felling or diversifying with large-seeded tree species and controlling grey squirrels in these and buffering areas, and manage for other key species such as nightjar where appropriate.
- Manage and expand broadleaved woodland cover, particularly along watercourses, on scarp slopes and in steep-sided valleys, enhancing the fragmented network of ancient semi-natural woodland and using trees of local provenance where possible.
- Protect, manage and expand stands of juniper scrub by fencing to exclude grazing and controlling rhododendron, to encourage natural regeneration augmented by supplementary planting of juniper of local provenance.
- Maintain livestock farming, with extensive grazing where possible, encouraging management that will create a mosaic of grassland types and structure including rushy pasture to provide feeding, roosting and breeding sites for birds, and expanding wet pastures and herb-rich grasslands in the valley bottoms.
- Expand areas of rough grazing and pasture on vulnerable dip and scarp slopes by encouraging reversion from arable cultivation.
- Protect and enhance the riparian habitats and water quality of the rivers and streams, retaining or reinstating a natural morphology, enabling fluvial processes and passage of fish.
- Maintain water quality through securing sustainable moorland grazing and heather burning regimes, managing livestock movements near watercourses, encouraging good soil and nutrient management throughout the catchment, controlling invasive species and restoring woodland along watercourses, thereby supporting fishing and wildlife watching.
- Protect and conserve the wealth of prehistoric and medieval archaeology, encouraging appropriate moorland and grassland management and where

appropriate reversion of arable to permanent grasslands, recognising the exceptionally high potential in this area for identifying further archaeological evidence of settlement and use.

- Protect and restore above ground heritage assets including traditional buildings such as farmsteads and bastles, and strengthening the historic field and settlement patterns, encouraging the restoration of dry stone walls and historic buildings using locally quarried stone where possible and ensuring any new developments are appropriate and in-keeping with the landscape and local vernacular.

- Conserve and restore key features of the designed parklands and gardens associated with the large country houses and castles which are an integral component of this landscape and which draw large numbers of visitors to the area.

- Protect and conserve the geodiversity of the area including protecting the distinctive sandstone crags, managing active and abandoned quarries and preserving and restoring the natural fluvial processes and geomorphology of the dynamic River Coquet.

- Provide access to and interpretation of the extensive geodiversity and heritage assets of the area and encourage their use for research and education, enabling more people to visit, enjoy and understand the interconnections between the physical geography, natural history and historical development of the area.

- Protect the highly valued tranquillity, open vistas, dark night skies and distinctive skylines that characterise this area by discouraging sources of disturbance and limiting inappropriate development.

- Enable appropriate access for all abilities, maintaining and expanding the public rights of way network and range of recreation opportunities, incorporating links to key geological and historical sites wherever possible, linking to tourism facilities and developing innovative activities to enhance people's access to and enjoyment of the natural environment in a responsible and sustainable way. Address issues of footpath erosion where necessary.

Heather and grass moorland on the broad ridge tops and upper slopes provides rough grazing for hardy sheep and cattle and supports a wealth of wildlife.

Ecosystem service analysis

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Food provision	Soils Semi-natural habitats Watercourses Livestock	This area is important for livestock production. 89 per cent of the land is grass and uncropped land which support 232,400 sheep and 24,400 cattle.	Regional	Despite its modest altitude the topography and poor soils of this area has dictated a farming pattern of extensive livestock rearing. Arable cultivation (9 per cent of NCA area) increased post-war but there has been a more recent trend towards returning fringe farmland to grass. Warmer, drier summers as a result of climate change may cause a shift towards more arable farming in the lowlands to increase fodder production for livestock. This could increase the risk of soil erosion, particularly on steeper slopes. The retention of viable livestock farming in the NCA is important both to the local economy and for the maintenance of the characteristic landscape and habitats. Locally sourced food can play an important role in supporting tourism in the area, and in the process help encourage a locally sustainable green economy.	Seek to support farmers and land owners in the production of food in ways that optimise productivity whilst maintaining biodiversity, historic features and landscape character. Supporting sustainable levels of grazing through agri-environment schemes, and particularly encouraging grazing of the uplands by cattle, is important for maintaining a viable livestock farming industry and managing the small-scale mosaic of upland habitats. Ensure agri-environment schemes are used to best effect to conserve and enhance wildlife-rich habitats and support the production of traditional food products such as lamb, mutton, beef and game using methods that sustain a healthy moorland environment, marketing them with reference to the special landscapes that their production helps to maintain. Ensure that 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 improve water quality and storage where possible.	**Food provision** **Water availability** **Genetic diversity** **Climate regulation** **Regulating water quality** **Regulating soil quality** **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
Timber provision	Soils Existing woodland Large-scale commercial plantations such as Harwood and Thrunton	Woodland covers 14,195 ha of the NCA (19.5 per cent) of which at least 10,217 ha (14 per cent of NCA area) consist of coniferous plantations. (The actual area covered by plantations is probably greater than this as this figure does not include new planting or recently felled areas.) Small- to large-scale plantations are scattered throughout the area and a large proportion of the woodland is within the Forestry Commission estate. Harwood and Thrunton are large-scale commercial plantations, areas of which are still being planted. Broadleaved woodland is predominantly associated with rivers, scarp slopes and some of the large country estates. The timber haulage industry is dependent on the four key transport routes that pass through this NCA. There are currently three sawmills and three woodfuel suppliers.	Regional	As woodland cover is already relatively high the potential for expansion without impacting on either moorland habitats or farmed land is probably limited. Many of the conifer plantations are now reaching maturity and some are being felled. Kyloe, Harwood and Raylees have been designated as red squirrel reserves and are also important for nightjar. Conifers can acidify watercourses so any new planting should consider the impacts on these. Felling can also impact on water quality through sedimentation and operations should be conducted in such a way as to minimise this risk. There are opportunities for the enhancement of conifer plantations on the summits and upper slopes through woodland restructuring schemes and replacement planting with broadleaves, especially along the edges, along rides and adjacent to watercourses. This would reduce the visual impact of these geometric blocks on landscape character. Additional measures to include improved access provision and recreational facilities should also be encouraged where appropriate. Encourage the removal of coniferous woodland where it impinges on adjacent landscapes such as river valleys or features such as craggy outcrops and significant archaeological sites. The removal of small discordant blocks of conifers, particularly on heather moorland where the restoration of moorland is feasible, with compensatory planting in more appropriate locations would strengthen landscape character, provide opportunities to restore open upland habitats, and strengthen the fragmented broadleaved woodland resource.	Encourage woodland management that will increase timber and woodfuel production whilst creating habitats for wildlife and enhancing the landscape. Encourage further removal and restructuring of conifer plantations through felling and broadleaved planting to benefit landscape character and biodiversity, taking opportunities created by felling to restore grass and heather moorland where appropriate with compensatory planting elsewhere. Where appropriate, provide opportunities to increase access provision and recreational facilities, such as new footpaths and bridleways, as part of changes associated with woodland management practices. Encourage the regeneration of semi-natural woodland, juniper scrub and wood pasture, diversifying the age structure of the woodland and strengthening landscape character. This could contribute to local provision of wood fuel whilst strengthening habitat networks, stabilising soil, reducing soil erosion and potentially assisting with water quality along watercourses. Continue to manage designated reserves and buffering areas for red squirrels, controlling grey squirrels, avoiding the clear-felling of areas and avoiding re-planting with large-seeded deciduous species. Providing areas suitable for nightjar within managed plantations.	**Timber provision** **Biomass energy** **Climate regulation** **Regulating water quality** **Regulating water flow** **Regulating soil erosion** **Sense of place/ inspiration** **Recreation** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability	High levels of precipitation Extensive areas of semi-natural habitat Reservoirs Rivers and streams including Till, Aln, Coquet, Font and Wansbeck	A small part of the north-western extent of the NCA overlies the Fell Sandstone Aquifer which has been assessed as 'no water available'.[4] Groundwater is predominantly abstracted from the aquifer to provide the public water supply for northern Northumberland. Industrial and commercial use is licensed for a much smaller proportion of water. The River Till is part of the River Tweed Special Area of Conservation and abstractions, which are predominantly for crop irrigation in the Cheviot Fringe NCA, are therefore currently licensed by Natural England. Summer abstraction from the River Till is consented up to the sustainable level and no additional water is currently available during the summer months. Surface water abstractions are likely to move to 'no water available' when the Environment Agency become responsible for licensing the Till.[5] The majority of the NCA is covered by the Northumberland Rivers Abstraction Licensing Strategy. The most dominant use (86 per cent) of licensed water is for public water supply, with agriculture and industry accounting for less than 7 per cent each. The remaining proportion is used for power generation purposes, but this amounts to very little.[6] Many isolated properties are not connected to mains water and rely on springs or boreholes for their water supply. The rivers Aln, Coquet and Wansbeck have 'water available'. The River Font has 'limited water available'.	Regional	There are concerns that there may be insufficient groundwater available to meet future demand. The Fell Sandstone outcrop plays an important role in aquifer recharge because much of the area is free from superficial deposits and consequently precipitation directly recharges groundwater levels. The extensive semi-natural habitats in this area are important for water infiltration and storage, increasing the opportunity for groundwater recharge. The ability of a catchment to maintain a constant flow rather than experience flood and drought episodes is improved by healthy soils and peat and wetland ecosystems with good vegetative cover, which improves infiltration of rainfall. The Till and Aln predominantly provide water for crop irrigation whilst the Rivers Coquet, Font and Wansbeck and the Fell Sandstone Aquifer provide public water supply. Climate change is likely to result in more intense precipitation events with warmer, drier summers in the long term, and future demand for water both for crop irrigation and public water supply is likely to increase. High levels of unsustainable abstraction create low flow levels that negatively impact on biodiversity and water quality so the amount of water licensed for abstraction may need to be reduced. It is imperative that water is used sustainably and land management practices are employed which will increase water infiltration both in this and downstream NCAs.	Seek opportunities to restore semi-natural habitats such as blanket bog , wet heath, mires, flushes, wet woodland and grassland to improve water storage capacity whilst reducing flood risk and soil erosion, improving water quality, climate regulation, habitat networks and ecosystem resilience to climate change. Improve sustainable use of water and sympathetic land management practices such as storage reservoirs constructed to form positive features within the local landscape and increase biodiversity interest, and water conservation measures in new development. Encourage good soil management such as avoiding poaching, over-grazing, compaction, and encouraging extensive grazing, to promote good soil structure and optimise infiltration of rain water into the aquifer.	**Water availability** **Biomass energy** **Climate regulation** **Regulating water quality** **Regulating water flow** **Regulating soil quality** **Regulating soil erosion** **Pollination** **Pest regulation** **Sense of place/ inspiration** **Biodiversity**

[4,5] Till Abstraction Licensing Strategy, Environment Agency (February 2013, URL: www.environment-agency.gov.uk/business/topics/water/119945.aspx)
[6] Northumberland Rivers Abstraction Licensing Strategy, Environment Agency (February 2013; URL: www.environment-agency.gov.uk/business/topics/water/119945.aspx)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Genetic diversity	Chillingham wild cattle Local and traditional livestock breeds	The wild Chillingham cattle are a rare breed that has been genetically isolated for hundreds of years in the enclosed park at Chillingham Castle. It is one of only two herds of wild white cattle in the UK, the other being on the Crown Estate in Scotland. This is an important area for rearing hardy hill livestock. There were 232,400 sheep and 24,400 cattle in 2009. [7]	National	The Chillingham cattle herd are not domesticated and are wild animals. Their behaviour may therefore give some insight into the behaviour of ancestral wild cattle. Their historic origins and genetic isolation make them an important and valuable asset and a tourist attraction. The wider area is grazed by hardy local breeds of sheep such as Cheviots and Northumberland Blackface sheep which are particularly well-suited to the climate, vegetation and topography of this area. This area is also grazed by hardy and native breeds of cow such as belted Galloway and Aberdeen Angus cattle. Promotion of these could be used to support a sustainable local green economy by encouraging local produce from traditional breeds.	Maintain and expand the herd of Chillingham wild cattle, providing information and interpretation to improve understanding of their historic and genetic interest. Encourage the use of traditional breeds for conservation grazing, particularly promoting the use of native cattle breeds for grazing the upland slopes and heathland. Support farmers in attempts to capitalise on the environmental value of local breeds and their heritage/genetic value. Encourage the promotion and development of supply chains and markets for high quality local produce from traditional breeds, encouraging a green economy that supports local tourism.	**Genetic diversity** **Food provision** **Sense of place/ inspiration** **Sense of history** **Recreation** **Biodiversity**

[7] Agricultural June Census Survey, Defra (2009)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biomass energy	Existing woodland cover	The existing woodland cover (19.5 per cent) offers high potential for the provision of biomass, either through bringing unmanaged woodland under management or as a by-product of commercial timber production. Yield potential for miscanthus is generally low, while in contrast, the yield potential for short rotation coppice (SRC) is high in the northern half and eastern side of the character area.	Local	There are opportunities to increase wood fuel provision through bringing unmanaged woodland under management, as a by-product of commercial timber production, and through planting of new woodland for flood risk management. There are already some wood fuel suppliers and saw mills in this NCA. Access will be important but this has the potential to provide environmental benefits such as restoring, expanding and linking woodland habitat and stabilising soils, whilst providing social and economic benefits. However, with the low population and scattered settlement pattern, the local demand is likely to be low. The impact on semi-natural habitats and landscape character of planting SRC limits potential sites to river valleys, and any planting would need to respect the existing scale and pattern of woodland planting there. For information on the potential landscape impacts of biomass plantings within the NCA, refer to the tables on the Natural England website.[8] Warmer and wetter climatic conditions and an increasing demand for biomass in the future may lead to a shift towards planting miscanthus but this would be out of keeping with the area's strongly pastoral nature.	Manage existing woodlands to improving age structure, diversity and long term survival, providing local sources of wood fuel. Seek opportunities to expand existing woodlands and create new woodlands, particularly on lower slopes and in river valleys, enhancing the fragmented network where this fits with landscape character and will not adversely affect historic features. Planting along rivers and on scarp slopes will have the added benefit of stabilising soils and reducing run-off. There may be opportunities to plant SRC along the eastern side of the NCA but the impacts on semi-natural habitats and landscape character, and the increased risk of soil erosion associated with cropping would need to be carefully considered.	**Biomass energy** **Timber provision** **Climate regulation** **Regulating water quality** **Regulating soil erosion** **Pollination** **Pest regulation** **Sense of place/ Inspiration** **Recreation** **Biodiversity**

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

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation	Soils with high carbon content Woodland Grassland	Soil carbon levels are high (20-50 per cent) across much of this NCA, associated with the large tracts of upland heath. Soils under the 14,195 ha (19.5 per cent of NCA area) of woodland within the NCA areas will also be relatively high in carbon, as will soils under grassland, and the woodland itself will provide carbon storage.	National	Peaty soils cover 37 per cent of this NCA and have the potential to store significant volumes of carbon but their capacity to act as carbon stores and sequester further carbon depends on the peat and associated habitats being in good hydrological and biological condition. High levels of carbon will also be stored in other soils under undisturbed, semi-natural habitats such as permanent grassland and woodland. It is anticipated that climate change and future increases in demand for food provision may result in a shift from pastoral to more arable land use in this NCA. This would increase soil disturbance, and combined with drying out of peat soils, would lead to significant loss of stored carbon. Sensitive land management and restoration measures such as grip-blocking should help to avoid further release of stored carbon to the atmosphere and could restore some of the carbon storage capacity and sequestration ability of the blanket bog and peat soils. Trees and woodland shading watercourses will help regulate conditions for aquatic species under a changing climate by reducing water temperature and thereby maintaining available oxygen levels. Trees and woodland in all locations also sequester carbon, help to regulate the impacts of severe weather events and provide potential sources of wood fuel.	Ensure that peat soils and associated habitats which are in good hydrological and biological condition remain under optimal land management regimes. Seek opportunities to restore areas of blanket bog and wet heath through sustainable land management practices and programmes of work to re-vegetate bare areas and encourage establishment of sphagnum to achieve a healthy and functioning acrotelm, so that the peat does not oxidise and active peat formation is encouraged. Encourage woodland management and planting, particularly alongside streams and rivers, where it would also benefit water quality, flood alleviation and biodiversity, but without detracting from the landscape, historic environment and recreation opportunities. Encourage extensive low-input grazing regimes on managed pastures and leys to reduce applications of artificial fertilisers and maintain carbon within the soils.	**Climate regulation** **Timber provision** **Water availability** **Biomass energy** **Regulating water quality** **Regulating water flow** **Regulating soil quality** **Regulating soil erosion** **Pollination** **Pest regulation** **Sense of place/ inspiration** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	High rainfall Rivers and streams Extensive semi-natural vegetation	Ecological river water quality is generally good or moderate; moderate reaches include much of the rivers Coquet, Aln and Till within the NCA. Fontburn Reservoir has moderate ecological potential whilst Colt Crag Reservoir has poor ecological potential.[9] The chemical quality of surface waters is generally not assessed but fails to achieve good status for Fallowlees Burn (which flows to Fontburn Reservoir) and the upper part of the River Font. The chemical quality of groundwater is poor across most of the NCA, including for the small area of the Fell Sandstone aquifer it overlays in the north west where elevated levels of nitrate, sulphate, potassium and volatile compounds have been detected.[10, 11, 12]	Regional	Elevated levels of nitrate, sulphate, potassium and volatile compounds detected in the Fell Sandstone groundwater unit are thought to be due to diffuse pollution from agriculture, localised industrial contamination, surface water contamination from mine water discharges and some contribution from non-mains drainage and mains sewer leakage. There are also issues of diffuse pollution from agricultural land for a number of the rivers. The Till, Aln and Coquet rivers all fall within a Priority Catchment designated under Defra's Catchment Sensitive Farming initiative. Diffuse pollution is being addressed through Catchment Sensitive Farming and agri-environment schemes, employing measures which reduce soil and nutrient run-off from agricultural land.[13] Flooding of the sand and gravel quarry at Caistron has previously caused water quality issues but this is now being addressed. The water quality of the rivers Tweed, Till and tributaries and Coquet is essential to the survival of the Atlantic salmon, sea trout, otter, brook and river lampreys, water vole, water crowfoot, and rich invertebrate fauna which are found there, as well as for the continuing reputation of these rivers as nationally important game fisheries. In addition to being a concern for local biodiversity, adverse effects on fish stocks and other wildlife could have a negative impact on the local economy if visitor numbers are affected. More extreme rainfall events as a result of climate change are likely to increase the risk of sediment and nutrient run-off, which could cause increased hydraulic scour and eutrophication effects. Warmer summers may raise water temperatures causing greater incidences of algal blooms and concentration of pollutants. Good farming practices to help reduce the risks of pollution in the NCA will therefore become even more important. These include maintaining good soil structure, minimising bank erosion by stock, minimising sediment run-off from arable fields, minimising pollution from sheep dips and appropriate timing and application of manure and fertiliser. Clear-felling of conifer plantations has the potential to cause a release of silt into water courses through surface run-off; operations must be conducted in ways to minimise this risk. Invasive species such as Himalayan balsam, giant hogweed, Japanese knotweed and signal crayfish are problematic in the lower stretches of the Till, Aln and Coquet catchments. Continuing to monitor and control these species is critical to ensuring the continued good ecological status of these watercourses.	Work with the farming community to promote best practice in soils, nutrient and pesticide management. This will include encouraging farmers to improve facilities for the storage of slurry and manure, sufficient to cope with more extreme weather conditions, and carefully managing stock movements and controlling riparian grazing to avoid poaching and erosion of the banks of watercourses. Matching nutrient inputs to needs will reduce nutrient run-off. Where cropping takes place, promote the use of in-field margins, headlands and winter cover crops, especially on sandy soils on slopes, and manage the timing of operations to avoid compaction and protect soil condition. Manage and extend areas of permanent grassland, scrub and woodland along watercourses. Seek opportunities to reduce pollution from industrial and mine water discharges to benefit watercourses and the Fell Sandstone aquifer and ensure gravel extraction adjacent to Coquet does not impact on water quality. Seek opportunities to improve management of non-mains and mains drainage and sewage. Restore areas of bare peat and encourage moorland management that ensures good vegetative structure and hydrologically functioning habitats to aid water infiltration and minimise soil erosion. Ensure good forestry practice is followed to minimise siltation from felling operations. Continue to monitor and control the spread of invasive species in the watercourses.	**Regulating water quality** **Climate regulation** **Regulating water flow** **Regulating soil quality** **Regulating soil erosion** **Recreation** **Biodiversity**

9 River Basin Management Plan Interactive Mapping, Environment Agency (accessed July 2013 from http://maps.environment-agency.gov.uk/wiyby/dataSearchController?lang=_e&textonly=off&topic=wfd_lakes)
10 WFD classification for Till Fell Sandstone Aquifer, Scottish Environment Protection Agency (2011) (accessed April 2013; URL: www.sepa.org.uk/water/monitoring_and_classification/classification/classification_results.aspx)
11 Northumbria River Basin Management Plan, Environment Agency (December 2009; accessed from www.environment-agency.gov.uk/research/planning/33106.aspx)
12 Solway Tweed River Basin Management Plan, Environment Agency and Natural Scotland (accessed from www.sepa.org.uk/water/river_basin_planning.aspx)
13 Catchment Sensitive Farming Funding Priority Statements 2010/11, Defra (accessed from http://www.defra.gov.uk/foodfarm/landmanage/water/csf/grants/index.htm)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow	Geology Soils Semi-natural habitats	The main rivers within the NCA are the Till, Aln, Coquet, Fallowlees Burn and the headwaters of the River Font. Only a small, rural stretch of the River Till lies within the NCA and associated flood risk to people and property is therefore low.[14] Flooding is a risk along the length of the River Aln and has been reported since 1770 but damage has been limited to bridges and agricultural land within this rural NCA. The physical characteristics of the River Coquet catchment, with its steep headwaters draining upland heather and peat moors in the Cheviot Hills, mean that it responds quickly to rainfall leading to a rapid onset of flooding. The main settlement at risk of flooding from the River Coquet within the NCA is Rothbury. Downstream flood risk exists in Felton (Mid Northumberland NCA) and Warkworth (South East Northumberland Coastal Plain NCA). The stretches of the River Wansbeck and River Font in this NCA are predominantly rural with a low risk of flooding. There is, however, significant risk of flooding downstream around Morpeth (Mid Northumberland NCA).[15]	Regional	The Environment Agency's preferred approach to managing this flood risk includes avoidance of inappropriate development in the floodplain of the Coquet and Aln, promotion of sustainable land management practices that reduce the amount and rate of runoff and erosion, new woodland planting along riparian zones, and investigation of measures such as floodwater storage in gravel pits upstream of Rothbury and in designated areas on the Wansbeck.[16, 17] One drawback of floodwater storage on the Wansbeck and other rivers, however, is that it may detrimentally affect the native white-clawed crayfish which are found there. The Coquet is identified within the Forestry Commission's Woodlands For Water initiative and it is hoped that new broadleaved planting schemes along its banks and on the flood plain could help slow down the flow of water thereby reducing flooding events at Rothbury and further down river. The Coquet in particular is a very dynamic river which still has a natural and dynamic morphology. This is critical to its biodiversity and geomorphological interest and key to the landscape character of the area. The risk of major flood events is likely to increase with climate change and there is a major opportunity to significantly enhance the regulation of water flow by restoring and creating multi-functional wetlands within the main river corridors and encourage the river systems to operate naturally.	Restore and enhance blanket bog and heathland habitats, securing sustainable grazing and burning regimes and encouraging programmes of work to restore hydrology and ecology to achieve good vegetative cover of bryophytes and heather, thus increasing water retention capacity and impeding water flow off the moors. Seek opportunities to extend floodplains and create flood storage areas along valleys, and manage to expand areas of wetland habitats, particularly meadows and wet pastures. Allow river systems to operate naturally, encouraging dynamic processes and extending wetlands to diffuse the energy of floodwaters. Promote good soil management on farms such as avoiding poaching, over-grazing, compaction, and encouraging extensive grazing, to improve infiltration of rainwater into agricultural land. Seek opportunities to restore and expand broadleaved woodland, particularly along riparian zones and in the flood plain of the Coquet, to improve water interception and storage and stabilise the banks of watercourses.	**Regulating water flow** **Water availability** **Climate regulation** **Regulating water quality** **Regulating soil erosion** **Sense of place/ inspiration** **Biodiversity**

[14] Till and Breamish Catchment Flood Management Plan Summary Report, Environment Agency (December 2009; accessed from www.environment-agency.gov.uk/research/planning/33586.aspx)
[15] Wansbeck and Blyth Catchment Flood Management Plan Summary Report, Environment Agency (December 2009; accessed from www.environment-agency.gov.uk/research/planning/33586.aspx)
[16] North East Northumberland Flood Management Plan Summary Report, December 2009 (Environment Agency), accessed from http://www.environment-agency.gov.uk/research/planning/33586.aspx
[17] Wansbeck and Blyth Catchment Flood Management Plan Summary Report, December 2009 (Environment Agency), accessed from http://www.environment-agency.gov.uk/research/planning/33586.aspx

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil quality	Geology Soil types Semi-natural habitats Land management	Almost half of the agricultural land is recorded as ALC Grade 5 (very poor quality), with the remainder comprising mainly Grade 4 (poor quality) and Grade 3 (good to moderate quality. There are 9 main soilscape types in this NCA: slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (covering 28 per cent of the NCA), slowly permeable wet very acid upland soils with a peaty surface (27 per cent), slowly permeable seasonally wet acid loamy and clayey soils (14 per cent), freely draining very acid sandy and loamy soils (10 per cent), very acid loamy upland soils with a wet peaty surface (9 per cent), freely draining slightly acid loamy soils (7 per cent), freely draining slightly acid sandy soils (1 per cent), loamy soils with naturally high groundwater (1 per cent), and raised bog peat soils (1 per cent).	Local	The loamy and clayey soils (42 per cent) may suffer compaction and/or capping as they are easily damaged when wet. This may lead to increasingly poor water infiltration and diffuse pollution as a result of surface water runoff. Management measures that increase organic matter levels can help reduce these problems. The upland soils with a peaty surface (27 per cent) are at risk of loss of organic matter through climate change and soil erosion. Measures should be encouraged that retain water in situ and potentially raise water levels, ensure good vegetative cover and avoid over-grazing, trampling or damage by mechanised activities. The freely draining very acid sandy and loamy soils (10 per cent) are generally easily worked though inherently infertile and some soils are susceptible to poaching.	Manage moorland habitats to ensure good vegetation cover and peat formation through encouraging sustainable levels of grazing and heather burning. Ensure the management of pastures and meadows encourages the build-up of organic matter, for example through extensive grazing regimes which will also reduce the risk of poaching. Encourage careful timing of mechanised activities and stock movement to avoid compaction of wet soils. Promote informed infield nutrient application and the use of green manure crops and winter stubbles in arable rotations to replace nutrients and bind soil.	**Regulating soil quality** **Food provision** **Climate regulation** **Regulating water quality** **Regulating water flow** **Regulating soil erosion** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil erosion	Soils with a peaty surface, freely draining acid loamy soils and sandy soils Semi-natural vegetation Land management practices	The soils in 55 per cent of this NCA are at risk of erosion. The slowly permeable wet very acid upland soils with a peaty surface (27 per cent) are at risk of erosion and carbon loss when they dry out. In common with the very acid loamy upland soils with a wet peaty surface (9 per cent) they are easily damaged by over-grazing or mechanised activities, particularly when soils are wet. The freely draining very acid loamy soils (10 per cent), freely draining slightly acid loamy soils (7 per cent) and freely draining slightly acid sandy soils (1 per cent) can erode easily on steep slopes during storm events, especially where vegetation is removed or where organic matter levels are low after continuous cultivation. Raised bog peat soils (1 per cent), although permeable and having a generally low risk of water erosion, may erode where cultivated land is susceptible to flooding. There is also a possible risk of wind erosion where surfaces are bare.	Regional	Soil erosion of the peaty soils is not currently a significant problem but measures should be encouraged which retain water in situ and retain vegetation cover to ensure it does not become one, particularly as climate change is likely to result in warmer, drier summers which will exacerbate the problem. Erosion of sandy soils under arable cultivation on the scarp and dip slopes is, however, a serious problem in this NCA. Some erosion is caused by wind but predominantly by water run-off. Measures such as reducing the intensity of cultivation, using low ground pressure tyres, increasing the use of in-field margins, planting winter cover crops and reversion to permanent pasture should be encouraged. In some cases a change in land-use to woodland should be considered, consistent with the Environment Agency and Forestry Commission Woodland for Water Project. The majority of the NCA falls within the Tweed, Aln, Coquet and Coastal Streams Priority Catchment designated under Defra's Catchment Sensitive Farming initiative and land management measures will be supported which reduce run-off of soil from arable fields.[18] There is a need to address the impacts of diffuse pollution on the River Till/ Tweed SAC, River Coquet SSSI and the Fell Sandstone Aquifer.	Opportunities should be sought to decrease the frequency and intensity of cultivation on vulnerable slopes, encouraging the use of low ground pressure tyres, promoting the use of in-field margins and headlands, and planting winter cover crops. Reversion to permanent pasture should be encouraged where appropriate, to protect the freely draining acid sandy and loamy soils, and in some cases change in land-use to woodland should be considered. Encouraging the restoration and reinstatement of hedgerows (where these are the typical field boundaries in valley bottoms) should reduce wind erosion as well as improving the valuable network of wildlife corridors. Securing sustainable grazing and burning management of moorland should reduce the risk of erosion of peat soils; good vegetative cover on blanket bog and heather moorland will reduce sediment run-off. In some places active restoration through measures such as grip blocking may be required. Seek opportunities to secure good grazing and cutting management of in-bye land and meadows to maintain good soil structure, improve infiltration and prevent channelling, run-off and flooding.	**Regulating soil erosion** **Food provision** **Water availability** **Climate regulation** **Regulating water quality** **Regulating water flow** **Regulating soil quality** **Biodiversity**

[18] Catchment Sensitive Farming Funding Priority Statements 2010/11, Defra (accessed from www.defra.gov.uk/foodfarm/landmanage/water/csf/grants/index.htm)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pollination	Semi-natural habitats	The extensive areas of heathland, particularly in the uplands of the south and west, provide important habitat for pollinating insects, as do the species-rich grasslands. While there is only limited crop production in this NCA this resource will be important for certain crop yields in the adjacent arable NCAs such as the Cheviot Fringe and the North Northumberland Coastal Plain.	Local	Pollination by insects is important for many crops to promote seed set and fulfil yield potential but research shows their numbers have declined sharply. Ensuring the presence of nectar and pollen sources throughout the flying season and the habitat structure required for all stages of their life cycles at a landscape scale, should help to increase pollinators which will benefit crops such as oilseed rape and field beans grown on lower lying land in this NCA and in adjacent arable areas such as the Cheviot Fringe NCA and North Northumberland Coastal Plain NCA. Changes in temperature, humidity and soil moisture as a result of climate change may decouple the phenologies of pollinators from their host plants, change exposure to pollinator pathogens and increase exposure to pesticides if summer rainfall declines. These potential impacts highlight the need for greater connectivity of habitats to allow species to shift and adapt.	Seek opportunities to increase connectivity for pollinators within the landscape, linking the semi-natural habitats of the uplands in this NCA with adjacent cultivated areas. Emphasis should therefore be on fringe areas and river valleys, enhancing the network of species-rich hay meadows, grasslands, woodlands, hedgerows, road verges and field margins. Plant early-flowering species such as goat willow to aid pollinators early in the season.	**Pollination** **Food provision** **Regulating water quality** **Regulating soil erosion** **Regulating water flow** **Pest regulation** **Biodiversity**
Pest regulation	Semi-natural habitats	The extensive species-rich and structurally diverse upland heathland habitats within this NCA will support pest-regulating species but the importance of this resource to commercial crop production is limited by distance. Ash dieback (Chalara fraxinea) is affecting ash trees in England. Ash forms a significant component of field boundaries and woodlands in this NCA.	Local	Regulation of pest species by natural predators can be encouraged through the provision of appropriate habitats and resources; the greater the diversity and complexity of habitats the more predator and parasitoid species are likely to be supported. Attention will need to be paid to the occurrence of ash dieback and other tree diseases which could have a significant impact on woodlands and field boundaries.	Seek opportunities to link the upland heathland with other semi-natural habitats in this NCA and with arable farmland through the enhancement of networks of species-rich grasslands, woodland, and field margins to encourage movement of natural enemies. Carry out surveys of trees as required to identify any occurrence of diseases such as ash dieback, and work with landowners and managers to control spread and introduce biosecurity measures where appropriate.	**Pest regulation** **Food provision** **Regulating water quality** **Regulating soil erosion** **Regulating water flow** **Pollination** **Biodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of place/ inspiration	Characteristic sandstone geology Open moorlands Sheltered, wooded valleys Rivers and streams Country houses and castles set in designed grounds and parkland Low population density; isolated farmsteads and villages Market towns of Alnwick and Rothbury Buildings constructed from local sandstone A wealth of heritage assets Tranquillity and dark night skies	A sense of place is provided by a distinctive and strongly contrasting landscape. Sandstone hills form the distinctive skyline characterised by level tops, north-west facing scarp slopes, and craggy outcrops. The open moorland habitats give way to scrub and broadleaved woodland on steep valley sides and scarp slopes with large, regular pastures bounded by dry stone walls. Extensive conifer blocks and shelterbelts often interrupt the pattern but provide some of the remaining strongholds of the iconic red squirrel. The sense of place is further reinforced by the traditional vernacular of dressed sandstone, local sandstone rubble, and the use of stone and Welsh slate, in the construction of towns, villages and farmsteads. The long history of occupation is evident in the wealth of historic features including 'cup and ring' marked rocks, bronze-age burial cists and iron-age hillforts, and the proximity to the Anglo-Scottish border is revealed through late-medieval defensive bastles. Major designed parklands associated with significant castles and country houses such as Alnwick Castle, Chillingham and Cragside are found at the foot of the fells, with extensive areas of semi-natural woodland. The area is sparsely populated with isolated farmsteads, often with distinctive tree belts, and small hamlets scattered in the valleys and on the lower slopes. These are served by the thriving market towns of Alnwick and Rothbury. Feelings of inspiration and escapism are likely to be associated with the strong and varied landscape, especially the rugged moors with their craggy outcrops, dramatic skies, panoramic views of the coast and across the lowland fringe to the Cheviots and dark night skies.	National	The long tradition of upland farming has shaped the landscape and maintaining its viability in the future will be key to securing sustainable and sympathetic land management. The demand for greater and cheaper food production has led to arable cultivation extending further up the slopes. Pressure to cultivate land is likely to increase in the future with the pressures of population growth and climate change. Development pressures have remained relatively low but housing and tourism developments around Rothbury and other valley settlements show signs of expanding onto the valley sides which will alter landscape character.[19] The increasing demand for wind energy is already resulting in significant numbers of applications for wind turbines with several wind farms already operational. There will be challenges in allowing the area to evolve, responding to changing pressures such as demand for renewable energy and increased tourism while protecting the landscape character and strengthening the sense of place. The loss of field boundaries (stone walls with some hedgerows in the valley bottoms) through neglect and replacement with post and wire fencing is weakening landscape character.	Protect contrasts between the open moorlands and pastoral lower slopes and valleys. Protect and enhance the moorland mosaics and other key habitats including pastures, hay meadows and broadleaved woodlands. Manage conifer plantations to 'soften' the impact on the landscape through restructuring and increasing the broadleaved component, and seek opportunities to remove blocks where appropriate, restoring open heathland where possible. Seek opportunities to increase grassland and wetland habitats through reversion from arable on scarp and dip slopes and in valley bottoms where appropriate. Seek ways to support viable and environmentally sensitive upland farming. Maintain and conserve the wealth of historic features that evidence the long history of occupation of these hills, seeking opportunities to connect local people and visitors with the history of the area. Manage and conserve the designed parklands which are a key component of the landscape, and maintain the iconic herd of Chillingham wild cattle. Seek opportunities to reduce the visual dominance of conifer plantations in the landscape through their removal or restructuring with broadleaved planting, but managing reserves for the iconic red squirrel. Restore traditional buildings using local building materials and styles where possible. Ensure new and re-developments respect the historic settlement patterns, using materials in keeping with the vernacular architecture. Maintain and restore dry stone walls, retaining the characteristic field patterns. Restore hedgerows in valley bottoms. Enhance recreation opportunities and ensure that appropriate access is provided to allow all levels of ability and interest to be able to appreciate and be inspired by the landscapes of the area.	**Sense of place / inspiration** **Genetic diversity** **Biomass energy** **Regulating water quality** **Regulating water flow** **Regulating soil erosion** **Sense of history** **Tranquillity** **Recreation** **Biodiversity** **Geodiversity**

[19] A Landscape Character Assessment of Tynedale District and Northumberland National Park: Final report to Tynedale District Council and Northumberland National Park Authority, Julie Martin Associates (June 2007; accessed from www.northumberlandnationalpark.org.uk/livingin/planning/planningpolicyandguidance/developmentplan/?a=144421)

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	'Cup and ring' marked rocks, bronze-age burial cairns, iron-age hillforts, standing stones and deserted medieval villages Pattern of piecemeal and regular enclosure defined by dry stone walls Bastles and peels as reminders of border conflict Evidence of industrial heritage Castles and country houses with parklands and grounds Isolated farms and nucleated villages Market towns of Alnwick and Rothbury Buildings constructed from local sandstone	A strong sense of history is evident in the complex, multi-period landscapes of this NCA, reflected in the abundance of prehistoric and medieval archaeological remains; one of the most important concentrations in England. Visible features include 'cup and ring' marked rocks, bronze-age burial cairns, iron-age hillforts such as Lordenshaw, Harehaugh, Doddington and Kyloe, standing stones and deserted medieval villages. The history of farming can be traced from Neolithic and bronze-age clearances, through the ridge and furrow cultivation of the medieval period to the larger and open rectilinear parliamentary enclosures of the 18th and 19th centuries bounded by dry stone walls. Reminders of the conflict and raids associated with proximity to the Anglo/Scottish border can be seen in the bastles, towers or 'peels' and castles found throughout the area. There is evidence of past small-scale iron and coal mining, iron-smelting and stone quarrying activity from the medieval period onwards. The historic character is further reinforced through the scattered farmsteads, small nucleated villages and the historic market towns of Alnwick and Rothbury with buildings constructed from local sandstone (dressed or rubble) with grey slate roofs. The castles and country houses with their extensive estates and grounds at the foot of the fells contribute much to the character of the area and are key tourist attractions. These include Alnwick Castle with grounds laid out by Capability Brown, Cragside and Chillingham. Abandoned railway lines of Alnwick to Cornhill and Morpeth to Rothbury. There are 3 Registered Parks and Gardens, 225 Scheduled Monuments and 735 Listed Buildings.	National	The Northumberland Sandstone Hills contain a variety of prehistoric sites which together form some of the most interesting archaeological landscapes in England. These are of national importance and, combined with the later historic features from the medieval period and large-scale reorganisation of the 18th and 19th centuries contribute much to the sense of history of this area. Historic features are threatened by a number of factors and activities including encroachment by vegetation and scrub, animal grazing and burrowing, forestry, dereliction and neglect. Wetter winters and hotter summers as a result of climate change are likely to exacerbate some of these issues: changes in soil moisture may lead to erosion of protective soils and vegetation leading to erosion of historic features, increased vegetation growth may obscure features and increase maintenance requirements, increased rain and storm events may damage the fabric of historic buildings, and climatic change may cause damage or loss of veteran trees in parklands. Changes in climate and increasing demands for food provision may also cause a shift towards arable cultivation which is likely to lead to increased disturbance of sites. A significant number of the Scheduled Monuments are on the English Heritage At Risk Register.	Protect and interpret historic landscapes which often contain evidence of multi-period occupation, retaining evidence of features and thus enabling improved understanding of past activities. Work with land managers to ensure that farming and forestry operations do not damage historic features, recognising the potential for as yet undiscovered below-ground archaeology. Encourage management of sites to control encroachment by vegetation and erosion by animals. Encourage the management and conservation of the historic designed parklands. Encourage the restoration of Scheduled Monuments and traditional buildings using local building materials and styles. Support the restoration and maintenance of dry stone walls and discourage the proliferation of post and wire fencing which may lead to a loss of enclosure pattern. Ensure new and re-developments respect the historic settlement patterns and reflect the local farmstead vernacular in terms of building materials, scale and location. Encourage further survey work to record the diversity and distribution of buried archaeology, earthworks and structures and encourage interpretation and educational experiences to help people understand and appreciate their significance, disseminating information to land managers and visitors alike. Provide clear and imaginative interpretation of sites and landscapes to improve the understanding and enjoyment of the public.	**Sense of history** **Regulating soil erosion** **Sense of place/ inspiration** **Recreation** **Biodiversity** **Geodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Tranquillity	Open moorlands Extensive forests Sheltered wooded valleys Few settlements Few major roads Dark night skies	This is perceived to be one of the most tranquil NCAs in England and 93 per cent of the area is classified as 'undisturbed' (CPRE Intrusion Map, 2007) (down from 98 per cent in the 1960s).	National	The open moorlands, rough crags, extensive forests, broadleaved woodland, meandering rivers, sparse settlement and dark night skies all contribute to the sense of tranquillity. The areas perceived to be the most tranquil occur towards the centre of the NCA around Harwood Forest. The least tranquil area is Alnwick and disturbance from visual intrusion and noise tends to be associated with this town and the major roads (the A1 which runs up the north-eastern edge of the NCA and the A697 which cuts across the middle). Otterburn Military Training Area occupies a small area of the western tip (approximately 2 per cent of the NCA area) and this, along with forestry operations and grouse shooting intrude at least locally on tranquillity. The perceived tranquillity and wilderness are highly valued by residents and visitors alike. Sparse settlement means the night skies are still dark; the Northumberland National Park Authority has applied (in 2013) for International Dark Skies Park status to include part of this NCA.	Protect the open vistas and sense of tranquillity by carefully considering the impact of new developments, including plantations, minimising the impact of structures such as wind turbines and controlling intrusion from developments including in the Otterburn Military Training Area. Minimise the impacts of light pollution from development in this and adjacent NCAs to retain dark night skies. Sensitively manage visitor access and recreational facilities to avoid loss of tranquillity. Promote the calming and restorative effects that contact with tranquil and sensory environments has on people's health and wellbeing.	**Tranquillity** **Sense of place/ inspiration** **Recreation**

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 Long distance trails Tranquillity Wild open moorlands and sheltered wooded valleys Forests Sandstone crags Reservoirs and loughs Parklands and gardens Castles and country houses A wealth of heritage assets Game fisheries	The NCA offers a network of rights of way totalling 699 km at a density of just over 1 km per km^2 as well as a significant amount of open access land covering 15,997 ha or just over 22 per cent of the NCA. 10,683 ha of the NCA (15 per cent) lies within the Northumberland National Park. Approximately 40 km of long distance routes pass through this area: St. Cuthbert's Way from Melrose to Lindisfarne crosses the northern end of the NCA and St. Oswald's Way from Lindisfarne to Heavenfield on Hadrian's Wall runs much of the length of the NCA. The Pennine Cycle Way also runs through the NCA (local section known as The Reiver's Cycle Route in reference to the historic border maraudings). There are important tourist attractions including the historic towns of Alnwick and Rothbury. Alnwick Castle and Gardens attract large numbers of visitors each year, particularly since the Castle featured as 'Hogwarts' in the Harry Potter films. In addition, there are other notable castles and country houses open to the public including Cragside (National Trust) and the privately owned Chillingham Castle which is famous for its wild cattle. Whilst there are no formal trails within the large public forest estate in this NCA walkers, mountain bikers and horse riders are welcomed. Many of the crags such as those along the Simonside Hills are very popular with climbers. The rivers Till and Coquet are nationally important game fisheries with large runs of salmon, sea trout and brown trout and many of the reservoirs and lakes are also renowned fishing locations.	Regional	The Northumberland Sandstone Hills offer a wide variety of tourist destinations and recreational activities based upon the special qualities of this environment, providing opportunities for improving visitor's health and well-being. Recreational use should continue to be encouraged but any increase in levels of use will 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 visitors with minimal impacts on the environment and consequently forests offer good recreational opportunities for activities such as walking, cycling, horse riding and wildlife watching. Increased usage of bridleways, particularly by bikes is already causing localised erosion. In the future hotter, drier summers and increased recreational pressure are likely to increase the risks of footpath erosion and wildfires. Warmer, drier summers are also likely to result in reduced water levels in waterbodies used for recreation. Species such as salmon which are sensitive to thermal stress may decline which will impact on the game fishing industry.	Maintain the network of footpaths and bridleways, encouraging the responsible use of the area by visitors to minimise footpath erosion and the risk of wildfires. Support a programme of path/route maintenance where appropriate. Conserve and promote access to the wealth of heritage assets and key sites such as castles and country houses, particularly where they act as local focal points and reinforce local distinctiveness. Access should be sensitively managed to avoid erosion of the landscape and archaeology. Provide imaginative interpretation of the landscape and its many features (geological, historical, species and habitats), providing opportunities to interpret this legacy for the understanding and enjoyment of all. Maintain and manage the high quality of the watercourses and waterbodies to provide good recreational experiences and the reputation of the area for its game fisheries and ensure there are no adverse effects on the landscape, biodiversity or the historic environment. Maintain and extend access and recreational opportunities in forests and other natural environments for walkers, cyclists, horse riders, and other users, providing suitable provision for all abilities. Ensure that tourism development is sustainable, sensitively utilises the landscape resource and brings socio-economic benefits to local communities.	**Recreation** **Genetic diversity** **Regulating water quality** **Regulating soil quality** **Regulating soil erosion** **Sense of place/ inspiration** **Sense of history** **Tranquillity** **Recreation** **Biodiversity** **Geodiversity**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity *(continued on next page)*	Sites designated for nature conservation Extensive semi-natural habitats including wet heath, dry heath, blanket bog, wet pastures and woodland Streams and rivers Reservoirs and loughs	The NCA has almost 13,500 ha of known BAP priority habitats of which 12,250 ha are upland heathland. Holburn Lake and Moss is designated as a Specially Protected Area (SPA) and a Ramsar site for its lowland raised mire habitat and large greylag goose roost. The River Till is part of the Tweed Catchment Rivers SAC designated for species and habitats including Atlantic salmon, brook and river lamprey, otter and water crowfoot. The River Coquet is designated as SSSI for salmon, lamprey and otter and for the oak, ash and alder woodland that is found along its banks. Simonside Hills SAC, Harbottle Moors SAC and a number of other Sites of Special Scientific Interest (SSSI) covering around 7,000 ha (10 per cent of NCA) are designated for mires, blanket bog, wet and dry heathland, calcareous grassland, meadows, woodland (particularly juniper scrub, oak, ash and alder) and birds (including hen harrier, peregrine, merlin, ring ouzel, black	National	Conserving and enhancing the mosaic of moorland habitats, retaining and enhancing the diversity including the transitional and fringe habitats, will preserve this much-enjoyed resource as well as benefiting biodiversity and contributing to services such as the regulation of climate, water quality and flow and soil erosion, while contributing to sense of place/inspiration and recreation. The heather moorland has historically been burned in large blocks for sheep grazing, with some management for red grouse, often resulting in large stands of uniform heather, and some wetter areas have been drained. The spread of bracken and rhododendron is an ongoing problem. Large areas of moorland have been lost to conifer plantations. Restoring heathland following the removal of conifer blocks will help to expand and connect the upland habitats on the ridgetops and upper slopes that have become fragmented. Managing rough grazing and pastures to provide a range of grasslands with varying hydrology, species richness and structure to support waders and other important species. Expand areas of grassland by reversion from arable, particularly on the more vulnerable scarp and dip slopes to retain landscape character and reduce erosion of sandy soils. Warmer summers and wetter winters combined with an increase in demand for food provision in the future is likely to see greater pressure to plough out areas for arable cultivation. Climate change is also likely to result in changes in species composition with a shift from heather to grassland, and drying of peatlands and other wetlands, increasing the risk of erosion and wildfires.	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. Protect and enhance the moorland mosaic by securing sustainable grazing and heather burning regimes, encouraging grazing by native breeds of cattle, controlling bracken and rhododendron, and where necessary, employing techniques such as grip-blocking. Ensuring that there is a mature heather component to the moorland mosaic to encourage breeding hen harriers, minimising disturbance during the breeding season, and encourage extensive management of rushy pastures for roosting. Identify areas of conifer plantation suitable for heathland restoration with compensatory planting in more appropriate places such as scarp slopes and along watercourses. Manage grazing levels of moorland fringe and permanent pasture to provide a mosaic of grassland types and structure including rushy pasture to provide feeding, roosting and breeding sites for birds. Seek opportunities for reversion from arable to permanent grassland on vulnerable scarp and dip slopes. Maintain and restore where necessary and appropriate the natural morphology of the rivers, encouraging natural fluvial processes and removing structures that form obstacles to the passage of salmonids (salmon, sea and brown trout) and lamprey. Maintain, enhance and extend the wet pastures, meadows and wet woodlands in the valley bottoms, creating corridors linking adjacent upland and lowland areas. Protect ancient woodland sites and bring plantations on ancient woodland sites under management to restore native trees and shrubs.	**Biodiversity** **Genetic diversity** **Biomass energy** **Climate regulation** **Regulating water quality** **Regulating water flow** **Regulating soil quality** **Regulating soil erosion** **Pollination** **Pest regulation** **Sense of place/ inspiration** **Sense of history** **Tranquillity** **Recreation**

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity *(continued from previous page)*		grouse, whinchat, golden plover, dunlin and curlew) and the invertebrate and amphibian assemblages found there. There are a further 36 Local Sites covering 10 per cent of the NCA. This area is important for a number of S41 bird species (NERC Act 2006), several of which use farmland habitats. Others are dependent on grassy, moorland fringe habitats, some on woodland and others on woodland edge. Kyloe, Harwood and Raylees conifer plantations have been designated as red squirrel reserves and are also important for nightjar.		The stream and river valleys harbour important but fragmented habitats such as wet pastures, herb-rich grasslands and remnant woodland. Restoring and linking these habitat fragments will improve the ability of the river valleys to act as corridors connecting adjacent upland areas like the Cheviots and lowlands to the east and west. Much of the remnant native woodland, particularly alder, is found along the watercourses. This has historically been coppiced in some places such as the Grasslees Valley. Acid oak, ash and birch woodland occur in the valleys and on scarp slopes. Nationally important relict stands of juniper, which would once have been much more widespread, are found in a few locations such as Bewick and Beanley Moors SSSI. Restoring and extending these woodland and scrub fragments, with particular emphasis on encouraging regeneration of juniper, by achieving sustainable grazing levels and controlling invasives such as rhododendron should create coherent ecological networks which will be more resilient to climate change, whilst strengthening landscape character. Ensuring good water quality in streams and rivers, restoring as natural a morphology as possible and controlling invasives such as Himalayan balsam, Japanese knotweed and signal crayfish will benefit the nationally and internationally important species found there and will ensure the continuing reputation of the rivers in this NCA as important game fisheries. Management of conifer plantations provides opportunities to improve structure and increase the deciduous component, thereby increasing biodiversity value and softening the impact on the landscape. Three of the larger plantations (Kyloe, Harwood and Raylees) have been designated as red squirrel reserves.	Seek opportunities to manage and expand the fragmented woodland network, connecting fragments of alder (and coppicing where appropriate), ash and oak, controlling rhododendron and encouraging the regeneration of juniper scrub. Maintain and enhance the larger areas of deciduous woodland associated with the estates of the large country houses and castles. Seek opportunities to restructure and increase the deciduous component of conifer plantations but managing designated areas and buffering areas for red squirrel and nightjar. In arable areas, encourage measures to support farmland birds and pollinators such as sowing wild bird seed and nectar flower mixes, cereal headlands and over-wintered stubbles, and increase connectivity with the landscape through scrub and woodland planting along watercourses, hedgerow restoration and field margin management. Work with the farming community to encourage land management practices that reduce diffuse pollution of watercourses, particularly run-off of sediment from arable fields on slopes. Monitor and control invasive species such as Himalayan balsam, Japanese knotweed and signal crayfish, and ensure game fishing continues at a sustainable level. Increase and improve the interpretation of the rich biodiversity of the area to improve public enjoyment and understanding. It may be most appropriate to locate this in tourist centres such as Rothbury and Alnwick and off-site literature as the area is a popular destination but a relatively wild upland area.	

Service	Assets/attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	Distinctive sandstone and limestone geology 4 geological SSSI	The bedrock geology of the Northumberland Sandstone Hills NCA is a mixture of sandstone and limestone. The Fell Sandstone, which gives rise to the distinctive hills, is one of the most prominent and best-exposed rock units in the Carboniferous succession of the Northumberland Trough. Sedimentary features typical of fluvio-deltaic alluvial plain sediments are outstandingly displayed in the crags.[20] Erosion has produced the highly distinctive series of bold 'cuesta' landforms; the long, conspicuous tiers of crags and bold escarpments giving rise to the distinctive skyline at Simonside and the crags at Harbottle. The sandstone gives rise to thin, acid soils which supports the characteristic heather moorland of the area. Other areas, particularly the river valleys, are blanketed in glacial till giving rise to more fertile soils and sand and gravel resources. The Coquet is a particularly fine example of a highly dynamic and unrestricted river. The Fell Sandstone is associated with a variety of prehistoric sites, which together form some of the most interesting archaeological landscapes in England. Iron and later coal was worked on a small scale from the medieval period onwards but has now ceased. Sandstone has long been quarried for building stone for use within and outside this area, for example millstones were dug near Harbottle Crags, stone for buildings in Rothbury was obtained from Pondicherry and a reddish purple siliceous sandstone for nearby Wooler and the surrounding area was quarried at Weetwood Bridge. A number of small-scale stone quarries are still active today and extraction of sand and gravel at Caistron on the Coquet only ceased in 2012.	National	The distinctive skylines and landforms, prehistoric features, historic quarries and sandstone buildings of this area are key to the strong sense of place. Improving interpretation of and access to the geodiversity of the area would enhance public understanding and enjoyment of the area and strengthen sense of place. The use of local materials in construction combined with the distinctive landscape has helped to create a strong sense of place. It is important that traditional buildings and dry stone walls are maintained and restored using local sandstone. Small-scale quarrying is continuing and re-working of historic quarries may occur for matching stone in old buildings but it is unlikely that these rocks will attract significant commercial interest in the near future.[21] Abandoned quarries are characteristic features of this landscape and provide some of the most important sites at which certain rock units may be seen, contributing greatly to the area's geodiversity. As such three historic quarries have been designated as SSSI. Old quarries also often provide significant biodiversity interest. The Coquet demonstrates dynamic fluvial processes and provides fine examples of channel braiding. It is important to ensure that any future extraction of gravel from the Coquet valley does not negatively impact on river morphology, habitats or water quality of this SSSI, and that opportunities for reclamation which provides high biodiversity value habitats are taken. The Fell Sandstone crags, including Simonside and Bowden Doors are popular for climbing. Climbers are generally aware of the need to respect the rock faces but there are opportunities to continue to work with groups to monitor and protect sites. Drier summers and wetter winters with more intense rain events as a result of climate change are likely to cause de-stabilisation of some geological features and increased vegetation growth may obscure features. Increased maintenance of important geodiversity may be required in the future.	Protect geological features, both natural and from past workings such as quarries, and encourage research and educational opportunities. Take opportunities presented by active quarries to record geological sections and collect representative specimens to further knowledge and understanding of the local geology. Encourage and support the designation of local geological sites. Improve access to and interpretation of geological sites and features and prehistoric heritage such as rock art ('cup and ring' marks), including designated sites and quarries, exploring and explaining the links between the geology, landscape, biodiversity and cultural heritage of the area to enhance the public's understanding and enjoyment of the area. Maintain and restore vernacular buildings and dry stone walls using local stone wherever possible to reinforce links with the underlying geology and strengthen sense of place. Preserve and restore natural fluvial processes and geomorphology, particularly of the Coquet. Ensure extraction of gravel does not impact negatively on the environment, particularly the Coquet SSSI, and ensure reclamation of sites provides high biodiversity value habitats. Continue to support the use of geological features such as crags for recreation but work with groups to monitor and protect sites.	**Geodiversity** **Sense of place/ inspiration** **Sense of history** **Recreation** **Biodiversity**

[20, 21] Northumberland National Park Geodiversity Audit and Action Plan, Commissioned Report 2007 (URL: www.northumberlandnationalpark.org.uk/understanding/geology/readmoregeodiversity)

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