National Character Area profile:

38. Nottinghamshire, Derbyshire and Yorkshire Coalfield

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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.

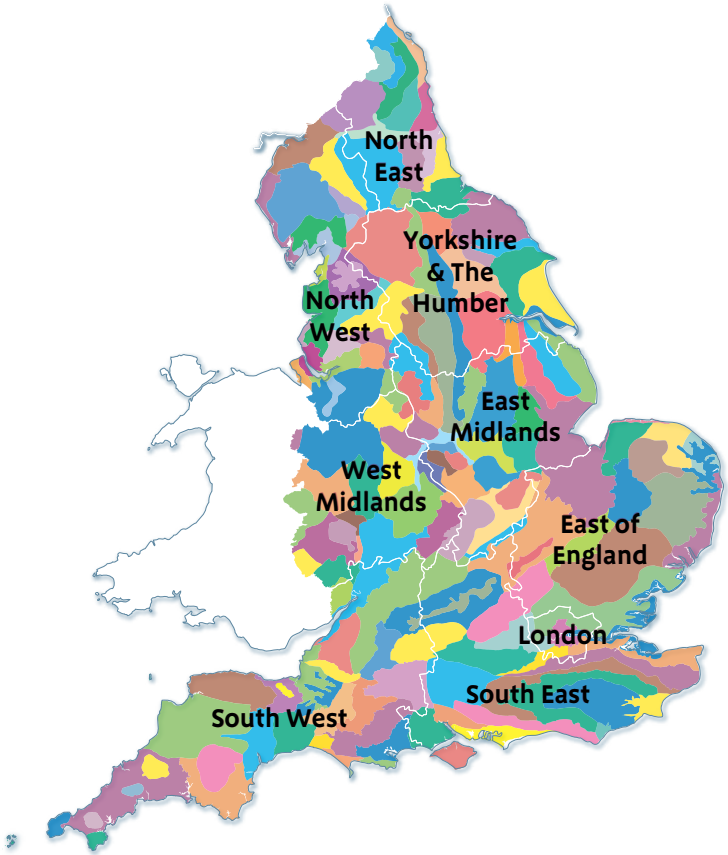
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and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

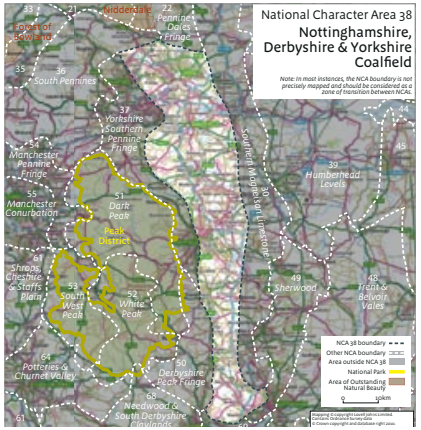
Summary

The Nottinghamshire, Derbyshire and Yorkshire Coalfield is an area that has seen great change over the past few centuries. The impact of widespread industrialisation and development on the landscape and settlement pattern within the National Character Area (NCA) is clear, influencing the visual and ecological landscape. The geological deposits of coal and iron, along with the water supply, brought mass industrialisation to the area to exploit these resources. A generally low-lying area, with hills and escarpments above wide valleys, the landscape embraces major industrial towns and cities as well as villages and countryside. Over half of the NCA (64 per cent) is currently designated as greenbelt land; this maintains some distinction between settlements and represents areas that are often under pressure for development and changes in land use. Very little of the NCA is designated for geology or nature conservation, but instead the landscape is dotted with many pockets and patches of habitat where species find refuge. This is often on land that was once worked for minerals or occupied by major industry, and as these enterprises have declined the land they once dominated has opened up with opportunities to create a new landscape which will continue to provide a strong sense of place for local populations.

The large populations of the towns and cities within the NCA mean that there will be opportunities to better engage people with the natural and historical environment, creating new access and recreational openings that deliver a better quality of life while also helping people and wildlife to adapt to a changing climate.

The NCA is an important area nationally for history, especially in relation to industrialisation and the story of its impact on the landscape. Opportunities should be taken to restore and maintain historical features in the landscape and to explore how they can be interpreted and used to educate and engage people with the landscape.

Rivers and waterways are an important feature in the landscape, often linking rural and urban areas and increasingly providing green corridors and tranquil settings for both people and wildlife. The source of the water is outside the NCA, as is the case for a number of ecosystem services, and the large population means that the area is a key user of ecosystem services (such as water) that are provided by surrounding NCAs. A key challenge will be to improve links between this NCA and others in order to get a better understanding of the delivery of ecosystem services and how they can be improved.



Click map to enlarge; click again to reduce.

Statements of Environmental Opportunity

- **SEO 1**: Restore and enhance existing areas and create new landscapes through the inclusion of woodland and networks of green infrastructure to raise the overall quality of design and location of new developments. Regeneration and restoration of industrial sites should seek to create green infrastructure that links fragments of the natural environment, leading to a functioning network for wildlife and access and recreational amenities for people.

- **SEO 2**: Protect and manage the archaeological and historical environment to safeguard a strong sense of cultural identity and heritage, particularly mining heritage, and use the area's distinctive sense of place to inspire interpretation and new development. Engage local communities with their past by enhancing the early, industrial and mining landscapes through restoration of key features of sites and improving access and interpretation.

- **SEO 3**: Conserve, enhance and expand areas and corridors of semi-natural habitat such as grasslands and woodlands to create a functioning ecological network that links the fragmented patches of habitats through urban and sustainably farmed environments, thus assisting species and habitat adaptation to climate change, reducing soil erosion and diffuse pollution.

- **SEO 4**: Manage, enhance and extend wetland habitats associated with the rivers Aire, Calder, Dearne, Don, Rother and Erewash and their tributaries to increase the landscape's ability to naturally and sustainably manage flooding, improve water quality, and increase the resilience of these habitats, the riverine landscape and associated species to climate change.

Rother Valley Country Park restored from opencast coal mining and a popular visitor destination for local residents in Rotherham, Sheffield and north-east Derbyshire.

Description

Physical and functional links to other National Character Areas

This National Character Area (NCA) is defined by underlying shallow Coal Measures and consists of the relatively low-lying land to the east of the Pennine chain, bounded by the Peak District National Park and the wool and engineering towns of the Yorkshire Southern Pennine Fringe to the west. Views of the upland areas to the west are imposing within many urban areas such as Sheffield and throughout West Yorkshire. The Pennines NCAs also provide a number of ecosystem services for the area, notably in terms of water provision, flood mitigation, carbon sequestration and recreational opportunities.

The Pennine Dales Fringe forms a boundary to the north and the NCA is separated from the Humberhead Levels and Sherwood NCAs to the east by the low ridge of the Southern Magnesian Limestone which provides an elevated backdrop to views out of the NCA in some areas. In the south, a small section of the area is bounded by the Trent Valley Washlands NCA.

Several rivers flow into the NCA from the west, notably the Aire, Dearne, Erewash, Don and Rother; they rise outside the NCA in the Southern Pennines and flow through the Southern Pennine Fringe, linking the NCA to the more upland areas to the west and then to easterly NCAs as the rivers continue their course to ultimately drain into the River Humber catchment. In the south of the NCA, the River Erewash flows east and south to join the Trent. Activities associated with these rivers upstream of this NCA may therefore affect the NCA, and activities associated with them within the NCA may also affect other NCAs downstream. Hard surfacing within the large urban areas increases the speed at which water enters the river system, and the canalisation of rivers through built-up areas can have a significant impact on flooding; the management of floodwater in this NCA will not only have impacts on other NCAs downstream but also provides opportunities for re-creating linked wetland habitat mosaics within the river valleys.

A number of canals link the NCA with other NCAs, notably the Leeds–Liverpool Canal and the Cromford Canal, which also connects the NCA with the Derbyshire Peak Fringe and Lower Derwent NCA. The canals have a very strong historical and recreational focus and are becoming increasingly important to local communities for recreation. The Cromford Canal is being restored in some sections, and the local Friends of the Cromford Canal group works to raise awareness of its heritage importance and to re-open and re-join sections of the canal.

Transport corridors are a strong feature in the NCA and provide links to adjacent NCAs to the north and south. Notably, the M1 runs from Leeds south through the NCA, ultimately linking up with London. The A1 is the main transport route north from Leeds into neighbouring NCAs. In addition, a number of railway lines pass through the NCA including now disused former mineral lines, many of which have been reclaimed to form new multi-user trails.

Key characteristics

- A low-lying landscape of rolling ridges with rounded sandstone escarpments and large rivers running through broad valleys, underlain by Pennine Coal Measures.
- Local variations in landscape character reflecting variations in underlying geology.
- Several major rivers flow through the rural and urban areas of the NCA, generally from west to east in broad valleys.
- A mixed pattern of built-up areas, industrial land, pockets of dereliction and farmed open country.
- Small, fragmented remnants of pre-industrial landscapes and more recent creation of semi-natural vegetation, including woodlands, river valley habitats and subsidence flashes, with field boundaries of clipped hedges or fences.
- Many areas affected by urban fringe pressures creating fragmented landscapes, some with a dilapidated character, separated by substantial stretches of intact agricultural land in both arable and pastoral use.
- A strong cultural identity arising from a history of coal mining, steel making and other heavy industry which resulted from the close relationship between underlying geology and resource availability, notably water power, iron ore and coal.

The NCA displays a mixed pattern of developed areas and farmed, open countryside.

Key characteristics continued

Key transport routes run through the NCA including major roads that have a large impact on the landscape.

- Features of industrial heritage such as mills, goits, tips, old railway lines, canals and bridges are evident, along with former mining villages.
- Many large country houses and estates established by wealthy industrialists in the 18th and 19th centuries and ancient monuments create focal points and important recreational opportunities within the landscape, such as Bretton Hall, Wentworth, Woodhouse, Temple Newsam, Nostell Priory, Bolsover Castle and the ruins of Codnor Castle.
- Extensive urbanisation, such as in the major cities of Leeds and Sheffield, with terraced and back-to-back housing and grand 19th-century municipal buildings and churches at their centres, now surrounded by extensive housing and industrial development.
- Widespread influence of transport routes, including canals, roads and railways, with ribbon developments emphasising the urban influence in the landscape.
- An extensive network of multi-user trails on former railway lines and canal towpaths, such as the Trans Pennine Trail and the Ebor Way.
- Continuing development pressure including land renewal and regeneration projects, especially along river corridors and around towns.

Nottinghamshire, Derbyshire and Yorkshire Coalfield today

Nottinghamshire, Derbyshire and Yorkshire Coalfield is a large area which embraces major industrial towns and cities as well as villages and wider tracts of countryside. The landscape is underpinned by generally low and variable hills, escarpments and broad valleys. It is dominated in the north and central part, and less so in the south, by extensive urban influences and industry. There has been constant change and development since the Industrial Revolution, when there was rapid expansion of housing, workshops, large factories and transport networks. The result is a complex intermingling of rural and urban, of modern commerce with occasional industrial dereliction, the whole creating a mosaic of disparate land uses with fragmented semi-natural habitats dispersed throughout.

The clays, sandstones and mudstones of the Carboniferous Coal Measures give rise to mainly poor soils which traditionally supported pasture, but now there is more mixed farming. Arable cultivation is more common on the better soils to the north and east, while permanent pasture is more frequent on the higher land to the west, with some stretches of relatively unspoilt pastoral landscape to the west of Barnsley and the Moss Valley between Sheffield and Chesterfield. One particular local speciality is early forced rhubarb, which is produced in the 'rhubarb triangle' between Rothwell, Morley and Wakefield.

Overall field size and pattern is very variable, reflecting medieval clearance from woodland, the piecemeal enclosure of medieval strip fields, the importance of miners' and weavers' subsistence plots and, in contrast, late 18th- and early 19th-century enclosure of commons. As a result of the expansion of farms (especially since 1950) and peri-urban influences, there are some areas where the field patterns remain intact, with thick hedges including oak and ash hedgerow trees, while elsewhere the field pattern has broken down, with more post and wire and rail fences and few trees.

Decline in heavy industries is being replaced with industrial and commercial developments. Good location and design of new buildings could make a positive contribution to enhancing the environment of the area.

In urban fringes there are often small fields of degraded pasture, horse grazing and other varied uses. The pressure of fragmentation and degradation in these areas can give an appearance of neglect. Sites that are left undisturbed can provide a refuge for wildlife, with areas of bare ground and rubble found in former quarries, clay pits associated with former brickworks, industrial sites and railway sidings supporting pioneer plant species and often an abundance of invertebrates as well as important exposures of the bedrock geology.

Semi-natural habitats, including woodland, grassland, important remnant lowland heaths, open water and river valley wetland habitats, tend to be fragmented and scattered, their scarcity giving them greater significance. The coal mining history of the area has resulted in areas of subsidence where low-lying fields become inundated with water; ings are common and often support important species owing to their unusual water chemistry. The river valleys in rural areas provide corridors of wetland habitat and the creation of new habitat within them offers important sites for wading birds and overwintering wetland birds such as goosander.

Restored spoil heaps and open cast areas provide opportunities for creating new areas of habitat, such as heathland and grasslands, with tree planting often used to help stabilise sloped sites. This also gives the opportunity to local communities to get involved in and learn about the restoration of their local environment. Tree cover is variable but generally low and present as small woodlands. In some areas broadleaved woodland creates a robust framework of calm, green backdrops to otherwise poor-quality development. Woodland is most notable on poorer soils on steeper slopes and in areas where concentrated planting has taken place, such as the planting around Barnsley and Sheffield by the South Yorkshire Forest Partnership and in West Yorkshire by the White Rose Forest Partnership.

Several major rivers cut across the area, including the Aire, Calder, Dearne, Rother, Don and Erewash, but their courses tend to be obscured by the development that has grown up around them. The removal of weirs and introduction of fish passes are helping to increase biodiversity in these rivers and reinstate historical passages for a number of fish species such as salmon.

Much of the area is dominated by the extensive towns and industrial activity, with mills and factories tending to be located along river courses. The once-active coal mining industry has now largely closed, with colliery sites and spoil tips graded out and restored to woodland and pasture, so that just a few tips are still in evidence. More recent engineering, manufacturing and light industrial uses, as well as commercial and retail sites, have extended out from the urban areas. As a result there is a dense network of roads, including the M1 running north–south and the M62 running east–west, railways and canals. Warehousing development around motorway junctions is a recent feature throughout and has a significant impact on the overall character of the landscape.

Many of the larger cities and towns, notably Leeds, Wakefield, Sheffield and Nottingham, have striking urban centres, dominated by the grand 19th-century architecture of their town halls, libraries, museums, schools and other municipal buildings, built with the wealth generated from mining, manufacturing and engineering. Industrial benefactors were responsible for many of these notable civic buildings, all constructed from local sandstones, as were some of the factories and mills.

Older traditional villages in the NCA were built of local stone, generally Coal Measures sandstones and Millstone Grit found to the west. The majority of settlements were, however, subject to rapid industrial expansion in the 19th

century when some completely new mining villages were also built. There are also areas with high densities of dispersed rural settlement owing to the mix of small-scale farming and employment in industrial and service activities. Locally produced brick and Welsh slate, often transported by rail, quickly replaced stone as the local building material, and many of the brick-built mining villages and towns from that period still survive today. Settlement expansion has continued and dominates the landscape over wide areas in the north of the NCA.

Historic buildings such as castle ruins, old churches, country houses and follies associated with country estates, and built with local sandstones, remain as important features and landmarks in the landscape. There are 34 Registered Parks and Gardens in the NCA including Victorian cemeteries but mainly parks associated with country houses built by wealthy industrialists. These also include the ring of parks around Leeds, notably Roundhay, the large estates overlooking the Doe Lea in north Derbyshire, including Hardwick Hall and Bolsover Castle, and the ruins of Codnor Castle overlooking the Erewash Valley. These large areas of parkland and woodland provide a refuge for many species within more built-up areas and important access to open space for the local population.

Country parks provide over 1,000 ha of accessible land within the NCA and are an important recreational asset, offering further opportunities to engage the local population. Reservoirs also provide opportunities for recreation, both active sites, for example Ulley, and inactive sites, such as Thrybergh. Recreational opportunities are provided by a large number of local walking initiatives, parks, reservoirs and canals, and links outside the NCA in the form of long-distance routes such as the Ebor Way. Further opportunities are afforded by closed mineral railway lines which have been developed into multi-user trails, such as the Trans Pennine Trail.

The river valleys of former mining areas today provide opportunities for habitat creation and creating a new landscape such as here at Adwick.

The landscape through time

In late Carboniferous times, this area formed part of an ancient coastline, where the cyclical flooding and building of swamp deltas along the former coastline resulted in the deposition of a series of coal layers (the compressed remains of the luxuriant swamp vegetation), interspersed with layers of shale, clay, sandstone and mudstone. These sediments now form the Coal Measures, which overlie the Millstone Grit and form the bedrock geology underlying the NCA and its major conurbations. Fossils within the various layers of the Coal Measures include mainly plants, but also marine shells and animals that lived in brackish water conditions, indicating that there were repeated advances and retreats of the shallow sea over the landscape throughout the Upper Carboniferous.

Several major rivers cross the area, including the Erewash, Aire, Calder, Don, Rother and, as seen here, the Dearne. Their courses have sometimes been heavily modified but they can form important foci for environmental enhancement and recreation.

The Coal Measures consist mainly of mudstone with beds of sandstone, many seams of coal and associated fossil soils. Like the Millstone Grit of the Pennine uplands to the west, the sandstones resist erosion and form a recurring pattern of escarpments that stand proud of shallow, mudstone-floored valleys. The sandstone beds of the Coal Measures are rather thinner than those of the Millstone Grit and hence the escarpments that they form are less dramatic, lower and more rounded.

Major rivers crossing the area have carved broad valleys with fertile flood plains created by alluvial deposits. However, the ridges generally run north-west to south-east, almost at right angles to the natural west to east flow of the rivers. In practice this gives rise to a characteristic pattern in the valleys where the rivers flow north or south until weaker sandstone or geological faults are encountered, when they will abruptly change course to flow into the next valley. Only in the north of the NCA has glaciation contributed to the shaping of some valleys such as the Aire Valley near Leeds with glacial till deposits around Bradford and Leeds.

It is, however, the working of coal by deep mining and later by open casting, together with resources of stone, fireclay, ironstone and soft water, which led to the greatest effects on the shape of the landscape by triggering the industrial growth which has been so dominant in its impact on the area.

Although much archaeological evidence of early settlement and land use has been obscured by later industrial development, there are Romano-British and earlier crop marks across the area and some linear earthworks marking significant boundaries, possibly refortified during the 10th century. Scattered Mesolithic and Neolithic evidence has been found along the River Don. Exceptions include the surviving stretches of Roman road at Rykneld Street.

By medieval times the clearance of the original forests had led to a farmed landscape with villages, hamlets and individual farms. Well-developed open field systems were common in the more fertile eastern soils but small, irregularly hedged and walled fields prevailed further west where rough grazing and pastoral farming dominated.

Medieval granges and moated sites, some within hunting forests and deer parks, were established. Codnor Castle is one of only two surviving medieval castles in Derbyshire. Holly trees were grown as winter fodder and holly remains a major component in many of the older hedgerows. After the mid 17th century the remaining open fields and commons were gradually enclosed, initially privately and then by Parliamentary Enclosure Acts, usually giving rise to more regularly shaped fields with predominantly hawthorn hedgerows.

Local resources of iron ore resulted in the development of an iron and steel trade by the early 17th century. A specialist cutlery industry soon developed around Sheffield, based on the fast-flowing streams which provided water power and local woods which were coppiced for charcoal. Butterley Steel Company, founded near Ripley, once produced 25 per cent of England's steel, which was renowned for its strength (and notably used for the spanned iron work at St Pancras station in London).

The area's streams and rivers were subject to intensive management from the medieval period in order to power fulling, textile and metal-working mills. With the combination of these natural resources and good-quality agricultural land, wealth was rapidly accumulated from the 17th century onwards. Former deer parks were often landscaped in the 18th century, usually retaining their herds of deer. Wealthy industrialists created a number of large country houses, parks and estates in the area in the 18th and 19th centuries, many of which still contribute to the character of the landscape today.

Saltaire, a World Heritage Site, is a model village created for workers at the Salts Mill.

Market gardening developed around the urban centres such as Leeds, Wakefield, Barnsley and Rotherham, all of which expanded rapidly from the late 18th century. This quick increase in population was linked to large-scale industrialisation. In the 18th and 19th centuries exploitation of rich local sources of coal for steam power allowed a massive expansion into large-scale steel (particularly around Rotherham and Sheffield) and manufacturing industry. The coal mining industry also developed dramatically, relying initially on canals and roads, and then on the expanding railway system for transport.

The landscape is rich in industrial archaeology, including features such as bell pits, mills and goits, tips, old railways and tramways, canals and bridges. Many of the woodlands also have strong industrial links, with oak having been managed for pit props or bark for the tanning industry, and with sycamore to provide bobbins for the local textile industry. Textile mills are concentrated in the north of the area and many remain as significant landmarks or focal points within the valleys. Leeds developed as a centre for flax and linen from the late 18th century, for cloth dyeing and finishing and later on for engineering and clothing.

Major mining growth from 1870 led to the development of new settlements in the early 20th century on sites in the eastern part of the NCA, where deep shafts were dug after 1908 (especially around Wakefield and Barnsley). The establishment of settlements based on mines gave a strong local culture to these communities, especially where new villages were established, such as at Fitzwilliam and Upton. Open cast mining developed on a larger scale from 1942, especially to the south and south-west of Barnbow.

While the industrial expansion led to an increase in terraced and back-to-back housing, it also resulted in the development of 'model villages' for workers such as the World Heritage Site at Saltaire. Many remaining areas of common land (for example Eccleshall and Hallam Moors) were enclosed with new farms during this period.

Pressure from development for housing, commerce and industry continues to impact on the character of the area and is likely to detract further from other landscape features and lead to a continued loss of tranquillity. The M1, first opened in the late 1950s and early 1960s, continues to be updated, and improvements in the transport network and new or improved roads generate further demand for development, especially warehousing at main junctions.

There are significant urban fringe pressures affecting the countryside, including greenbelt around villages, towns and cities. This, along with fragmentation of viable holdings, makes farming difficult. Some rural buildings are being sold off, usually for conversion to residential use, which results in a degree of suburbanisation of the countryside.

Over recent decades, large-scale programmes of reclamation of coal spoil heaps and other industrial dereliction have created a greener appearance and clear evidence of a new generation of reclaimed landscapes, as can be seen in the Dearne Valley which sits across the borders of Barnsley, Rotherham and Doncaster and the Erewash Valley in Nottinghamshire. Many areas of woodland have, for example, been planted in the past ten years, especially within the Community Forest areas. River corridors have also been the focus for nature conservation, greening and regeneration projects, improving them as important corridors for wildlife and recreation.

Ecosystem services

The Nottinghamshire, Derbyshire and Yorkshire Coalfield 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 Nottinghamshire, Derbyshire and Yorkshire Coalfield NCA is contained in the 'Analysis' section of this document.

Provisioning services (food, fibre and water supply)

- **Food provision**: The centre of the NCA remains fairly rural with 44 per cent of the area made up of Grade 3 agricultural soils. It is a mixed farming area, predominantly producing cereals, with a variety of crops being common including oilseed, but it also supplies fattened livestock and some dairy produce.

- **Water availability**: Several major rivers cross the area, including the Don, Aire, Calder, Dearne, Rother and Erewash. There is generally water available from surface waterbodies throughout the NCA. However, the NCA does not overlie any major aquifer; the north of the area around Bradford and Leeds overlies a minor Millstone Grit aquifer which has water available, while the middle stretch overlies a minor Coal Measures aquifer which also has water available for further abstraction.

- **Biomass energy**: The existing woodland cover in this NCA (15,411 ha or 9 per cent of the area) offers some potential for provision of biomass by bringing unmanaged woodland under management and as a by-product of commercial timber production. There is generally a medium potential yield for miscanthus in the NCA, with a high potential yield around Rotherham and Leeds. There is also a medium potential yield for short rotation coppice, with a low potential yield around Sheffield.[4] Barnsley's communal biomass heating system is the UK's largest working example of a process using wood arising from local woodland management to heat community housing.[5]

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

- **Climate regulation**: The majority of the soils have low carbon content. However, the carbon content is likely to be higher under woodland (9 per cent of the area), which will also continue to sequester carbon from the atmosphere, and under the 1,200 ha of lowland meadow, semi-natural grassland, heathland and wetland in the NCA.

- **Regulating soil erosion**: 64 per cent of the soils in the NCA are at low risk of erosion. Just less than 25 per cent of the area has light soils (freely draining, slightly acid loamy soils and freely draining, lime-rich soils) which have an enhanced risk of soil erosion on moderately or steeply sloping land where cultivated or bare soil is exposed. This is exacerbated where organic

[4] Natural England website, Opportunities and optimum sitings for energy crops (accessed December 2010; URL: www.naturalengland.org.uk/ourwork/farming/funding/ecs/sitings/default.aspx)
[5] Forestry Commission, Barnsley Biomass: *Working towards carbon emissions reduction in Yorkshire* (available at: www.biomassenergycentre.org.uk/pls/portal/docs/PAGE/BEC_TECHNICAL/REF_LIB_TECH/EXISTING%20INSTALLATIONS/BARNSLEY_BIOMASS.PDF)

matter levels are low after continuous arable cultivation and where soils are compacted. These soils also have the potential for wind erosion on some coarse textured cultivated variants.

Restored soils derived from mineral workings and coal mining and open cast spoil are often compacted and subject to erosion from rainfall which cannot infiltrate the soil. Poaching is a risk where stocking levels are too high on wet ground. Equally, many of the slightly acid loamy and clayey soils with impeded drainage are prone to capping and slaking, leading to increased risk of erosion, especially when they are compacted by machinery or livestock if accessed when wet. This increases the risk of soil erosion by surface water run-off, especially on steeper slopes.

- **Regulating soil quality**: The slowly permeable, seasonally wet loamy and clayey soils that cover 58 per cent of the NCA, are easily damaged when wet. These soils may have limited potential for increasing organic matter levels by management interventions, making the timing of agricultural practices and stocking management more important in maintaining soil quality.

- **Regulating water quality**: 80 per cent of the NCA falls within a nitrate vulnerable zone. The ecological status of surface water is generally moderate, although there is considerable variation from 'good' to 'poor' across the NCA. The chemical status of surface waterbodies in the NCA generally 'does not require assessment', but there are some river reaches with 'poor' water quality, including those around Sheffield and Leeds. The chemical status of groundwater across the NCA is 'poor'.

Around Sheffield and Rotherham, the rivers Don and Rother are heavily urbanised. The River Don takes a large volume of treated effluent from Blackburn Meadows Waste Water Treatment Works (WWTW) in Sheffield while the Rother takes treated effluent from Old Whittington WWTW in Chesterfield. Key measures to help to restore better water quality are diverse and include the use of sustainable urban drainage systems in urban areas and new developments, the management of nutrient inputs in rural areas and the upgrading of sewage treatment works.

Restoration of former mining sites for biodiversity and recreation close to where people live has meant large changes in the landscape over the past twenty years.

- **Regulating water flow**: Fluvial flood risk is substantial throughout much of the NCA. In Barnsley, Rotherham, Sheffield and Chesterfield, the top three or four flood peak events since monitoring began have occurred since 2000, indicating the significance of recent flood events. In many locations flood risk is located in urban areas where development has taken place within the flood plain and in city centres where high-value developments sit on the front of heavily modified waterways.

  Where possible, re-naturalisation of the waterways can help to slow water flow and alleviate flooding downstream. In many places large flood storage options in rural areas are being developed to help to protect homes and urban businesses. Examples include the extensive washlands north of Castleford which are designed to reduce the threat of flooding in the town, as well as to protect arable land further downstream.

Cultural services (inspiration, education and wellbeing)

- **Sense of place/inspiration**: A sense of place has been created by the exploitation over many centuries of coal deposits, together with resources of stone, iron and soft water, which has resulted in a complex intermingling of an earlier rural landscape with modern commerce, industrial sites and structures, and abandoned industrial areas clothed over low hills and escarpments and broad valleys. The landscape is heavily influenced by these areas of industry and by the towns and cities of Leeds, Wakefield, Barnsley, Rotherham, Chesterfield, Derby, Nottingham, Sheffield and Bradford. The historical industries within these towns and cities still provide an important sense of place and identity for the local communities, such as connections with the wool industry in Leeds and steel production in Sheffield.

  The NCA also contains a number of large country houses, parks and estates while the main cities and towns have striking centres dominated by fine 19th-century civic buildings constructed with sandstone. These features provide opportunities to engage the population and to promote a greater understanding of the cultural history and greater engagement with the landscape around them. The landscape has provided inspiration for a number of cultural works, notably D H Lawrence, who was born and lived in Eastwood and used the area as an inspiration for a number of his works.

- **Sense of history**: There is a long history of settlement within the NCA dating back to evidence of Mesolithic and Neolithic camps with river valleys used as travel ways throughout the ages. Much of the evidence of activity by earlier generations has, however, been lost to the widespread urbanisation that took place from the 18th century onwards as a result of large-scale industrialisation and the rapid increase in population. One notable exception is Codnor Castle, the remains of a medieval castle. The legacy of industrial development is still very apparent in the landscape today in the mining villages and where equipment is still visible, such as some pit heads and brickwork towers. It is the evidence from this era that provides the clearest sense of history within the NCA. The wealth produced by industrialisation is also apparent in the grand municipal buildings and large number of country houses and estates. There are many opportunities to increase understanding of the history of the area and its links with local culture and pride, including the management of woodlands and increased opportunities for recreation provided by the parks, gardens and estates.

- **Recreation**: The NCA offers a network of rights of way totalling 2,920 km at a density of just over 1.7 km per km2, including the Trans Pennine Trail and Ebor Way long-distance routes. There is only a small area of open access land covering 508 ha or just 0.3 per cent of the NCA, but there are areas of open space resulting from the restoration of past mineral workings. The large number of Registered Parks and Gardens are also important recreational assets for local communities, with a number of country houses and estates drawing in visitors from further afield as well. Most green spaces within the NCA experience high levels of usage because of their importance as a source of recreation for surrounding large urban populations and the opportunities for people to connect to the natural environment, such as along the Erewash Valley Trail.

- **Biodiversity:** Biodiversity Action Plan (BAP) priority habitats make up a total of 3 per cent of the area (low in comparison with the national average), and comprise wet woodland and lowland mixed deciduous woodland. Other BAP priority habitats include lowland meadows, undetermined grassland, heathland and flood plain grazing marsh. There is only one internationally designated site within the NCA: the Denby Grange Colliery Ponds Special Area of Conservation (19 ha) in Wakefield, designated for its high counts of great crested newts.

  Within the wider landscape there is a patchwork of semi-natural habitats that are either remnants of previous extent or are now being restored. There are lots of opportunities within the landscape to buffer and link up these patches of habitats to reduce fragmentation and increase the permeability of the area. New developments provide opportunities to raise design quality by incorporating green infrastructure and habitat creation as part of master planning, and can have a large positive or negative effect on the overall ecological network and landscape character of the area.

- **Geodiversity:** There are eight geological Sites of Special Scientific Interest in the NCA, which are often the result of human activity, for example railway cuttings, building stone quarries and brickworks. Nationally and locally designated sites provide opportunities for education at all levels and scientific research, and to make clear links between the underlying geology and human history and development. The East Pennine Coalfield is the European reference area for the stratification of the Late Carboniferous period, making the geological exposures in this NCA important.

The NCA has many, different opportunities to improve and increase recreation for the local population.

Statements of Environmental Opportunity

SEO 1: Restore and enhance existing areas and create new landscapes through the inclusion of woodland and networks of green infrastructure to raise the overall quality of design and location of new developments. Regeneration and restoration of industrial sites should seek to create green infrastructure that links fragments of the natural environment, leading to a functioning network for wildlife and access and recreational amenities for people.

For example, by:

- Reclaiming and restoring areas of contaminated and degraded land to create new post-industrial landscapes through the creation of habitats to strengthen local habitat networks and provide opportunities for recreation for local populations, while retaining links to industrial heritage.
- Creating green spaces close to where people live which are easily accessible, especially in regeneration zones within old mining areas and in inner-city developments.
- Creating new landscapes that are sympathetic to the local landscape character and incorporating habitats that will contribute to biodiversity and climate change mitigation, through careful planning of green infrastructure, such as in Waverley between Sheffield and Rotherham.
- Ensuring that new development is located and designed with particular consideration for keeping important open views, and using tree and shrub planting of native species to assist in assimilating built structures, especially in urban fringe areas outside major urban areas such as Derby and Nottingham.
- Incorporating biodiversity and geodiversity in old quarries and on previously developed land into area plans and master plans for future developments, for example around Sheffield where old industrial sites are being regenerated.
- Realising the potential for canals and rivers to provide sustainable travel and access corridors alongside other green infrastructure benefits, for example the Chesterfield and Cromford canals.
- Incorporating past industrial land, such as disused railways, and recognising their important role for geodiversity and in providing linking corridors for biodiversity and recreation.
- Creating new permissive access routes, for example around reservoirs, and links to long-distance routes such as the Ebor Way and Trans Pennine Trail, and ensuring that some surfaced paths are provided for use by people of all levels of ability.

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SEO 1: Restore and enhance existing areas and create new landscapes through the inclusion of woodland and networks of green infrastructure to raise the overall quality of design and location of new developments. Regeneration and restoration of industrial sites should seek to create green infrastructure that links fragments of the natural environment, leading to a functioning network for wildlife and access and recreational amenities for people.

For example, by:

- Creating new recreational opportunities within developing landscapes in response to the Yorkshire and Humber Green Infrastructure Framework and the 6Cs Green Infrastructure Strategy, improving the quality of the environment for local residents and providing 'places to escape from it all' and easy access routes close to centres of population.
- Ensuring that country parks and accessible parklands and woodlands are maintained and managed so that they contribute both to the quality of the environment and to biodiversity networks.
- Ensuring that parklands are under management that maintains their historical value while enhancing the biodiversity and recreational benefits that they offer, and their settings.
- Integrating the co-ordinated provision of green infrastructure in developments to offer the local community opportunities to enjoy their local green spaces and take action to improve them.

SEO 2: Protect and manage the archaeological and historical environment to safeguard a strong sense of cultural identity and heritage, particularly mining heritage, and use the area's distinctive sense of place to inspire interpretation and new development. Engage local communities with their past by enhancing the early, industrial and mining landscapes through restoration of key features of sites and improving access and interpretation.

For example, by:

- Conserving industrial buildings and associated features, for example civic buildings, bell pits, mills, mining artefacts, canal networks, bridges and characteristic terraced housing, and encouraging interpretation of their role in the historical development of the area.
- Using an understanding of the area's traditional and historic architecture, and its distinct patterns of settlement, to inform appropriate conservation of historic buildings, and to plan for and inspire any environmentally beneficial new development which makes a positive contribution to local character.
- Managing and restoring traditional field boundaries, particularly where they are most visible in the landscape, form regular patterns and enclose coherent survivals of historical fields.
- Conserving, maintaining and restoring the area's distinctive farmsteads, including those with nationally significant evidence of industrial use.
- Managing and interpreting disused quarries and other mineral workings to provide opportunities for geodiversity, recreation and education for schools, universities and people who are interested in the influence of the underlying geology on the history of the area, and for scientific research.
- Encouraging traditional production such as rhubarb in the 'rhubarb triangle' between Morley, Rothwell and Wakefield and products such as Yorkshire forced rhubarb, protected by the European Commission's Protected Food Names scheme, which give areas a sense of identity.
- Providing heritage interpretation for the many sites of historical, industrial, geological and cultural heritage interest, which contributes to a sense of local identity. Examples include castle ruins, country houses, remaining pit heads and brickworks.
- Using local materials (sandstone and millstone for building, with stone flag or pantile roofs as appropriate) for restoration of traditional buildings to preserve visual unity and the connection with the underlying geology.

SEO 3: Conserve, enhance and expand areas and corridors of semi-natural habitat such as grasslands and woodlands to create a functioning ecological network that links the fragmented patches of habitats through urban and sustainably farmed environments, thus assisting species and habitat adaptation to climate change, reducing soil erosion and diffuse pollution.

For example, by:

- Ensuring that existing areas of heathland are protected and managed, restoring it where possible and ensuring that sites are buffered with sensitive land management which will protect the heathland interest, and linking it to other semi-natural habitats where possible.
- Widening the range of habitats in arable areas, particularly in the low-lying east of the NCA and in valleys, including the introduction of permanent grassland field margins and linking these to the wider grassland resource where possible.
- Managing and enhancing the fragments of rough grazing, grassland habitats, lowland pastures and hay meadows in lowland areas, as valuable habitats for strengthening landscape character and enhancing biodiversity, including managing livestock levels to reduce poaching, and seeking ways of connecting them.
- Managing and restoring traditional field boundaries, particularly where they are most visible in the landscape, form coherent patterns and enclose historical fields, respecting differences in local styles.
- Encouraging uptake of land management practices to support farmland bird populations, especially near to valley wetland habitats.
- Encouraging land management practices such as creating grassland buffer strips and grass verges, reducing fertiliser inputs and managing rush pastures to provide a buffer to soil erosion and nutrient run-off in areas of arable production, particularly adjacent to watercourses.
- Increasing the planting of native trees and shrubs, and extending biodiversity networks, responding to the Yorkshire and Humber Green Infrastructure Framework and the 6Cs Green Infrastructure Strategy.
- Avoiding further fragmentation of agricultural land and semi-natural habitats.
- Increasing areas of native woodland within the landscape for recreational use, providing local sources of wood fuel and incorporating new development, while strengthening the ecological habitat network.
- Managing the area's diverse range of woodlands, veteran trees, wood pasture and parklands to enhance landscape character and safeguard their biodiversity value while seeking opportunities to enhance access.
- Planning for new opportunities to plant woods and new areas of wood pasture to expand existing sites, and to create short rotation coppice to enhance timber and biomass provision, increase carbon storage, regulate water flow and quality, and reduce habitat fragmentation.

SEO 4: Manage, enhance and extend wetland habitats associated with the rivers Aire, Calder, Dearne, Don, Rother and Erewash and their tributaries to increase the landscape's ability to naturally and sustainably manage flooding, improve water quality and increase the resilience of these habitats, the riverine landscape and associated species to climate change.

For example, by:

- Restoring and extending fens and flushes to enhance biodiversity. This will help to improve water quality by filtration.
- Increasing semi-natural habitats to help to slow down the volume of water entering the river system during and after storms and periods of heavy rain. This has been trialled upstream of Leeds in the Upper Aire Valley.
- Restoring natural river dynamics and profiles, re-connecting rivers to their flood plains and restoring relic water features, and creating and expanding marginal habitats such as wet woodland, scrub and permanent grassland, seeking ways to mitigate the heavily modified courses and urban influences in order to relieve water flow in the river systems.
- Encouraging buffers of permanent grassland around wetlands, streams and rivers to enhance ecological quality and reduce diffuse pollution from agriculture, such as through the lower river valleys of the Aire and Dearne.
- Promoting land management practices to reduce erosion and pollution.
- Maintaining undeveloped flood plains to store water, and seeking opportunities to expand washlands and water storage in flood plains.
- Protecting and increasing trees on urban streets, and promoting sustainable urban drainage systems and green spaces to aid interception and infiltration of rain water and slow run-off.
- Ensuring that the restoration of previous mining sites aids water flow regulation and, through their management, contributes towards flood management. Controlling and managing the presence and introduction of non-native species within wetland habitats (the history of residential and commercial developments along watercourses within the NCA increases the issue of non-native species introductions here).

Supporting document 1: Key facts and data

Total area: 169,753 ha

1. Landscape and nature conservation designations

There are no national landscape designations within this NCA.

Source: Natural England (2011)

1.1 Designated nature conservation sites

The NCA includes the following statutory nature conservation designations:

Tier	Designation	Name	Area (ha)	Percentage of NCA
International	Ramsar	n/a	0	0
European	Special Protection Area (SPA)	n/a	0	0
	Special Area of Conservation (SAC)	Denby Grange SAC; Colliery Ponds SAC	18	<1
National	National Nature Reserve (NNR)	n/a	0	0
	Site of Special Scientific Interest (SSSI)	A total of 25 sites wholly or partly within the NCA	375	<1

Source: Natural England (2011)

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

In total 377 ha of the NCA is designated for conservation, this represents less than 1 per cent of land within the NCA. Denby Grange Colliery Ponds is the only site with a European conservation designation and is also designated nationally as a SSSI. Denby Grange Colliery Ponds SAC is important for the population of great crested newts (Triturus cristatus). Resource extraction activity in the NCA has left a number of features that have provided the opportunity for habitat establishment and now provide areas with good examples of habitats that would have been more prevalent locally in the past.

There are 693 local sites in Nottinghamshire, Derbyshire and Yorkshire Coalfields covering 8,115 ha, 5 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** – select 'Designations/Land-Based Designations/Statutory'

1.2 Condition of designated sites

SSSI condition category	Area (ha)	Percentage of SSSI in category condition
Unfavourable declining	57	15
Favourable	222	59
Unfavourable no change	8	2
Unfavourable recovering	88	23

Source: Natural England (March 2011)

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

2. Landform, geology and soils

2.1 Elevation

Elevation ranges from just 10 m above sea level, to 290 m, although the mean is 96 m, thus overall the NCA is relatively low-lying.

Source: Coal Measures Natural Area Profile, Nottinghamshire, Derbyshire and Yorkshire Coalfield Countryside Character Area description

2.2 Landform and process

The landscape is underpinned by generally low and undramatic, but variable hills, escarpments and broad valleys. Numerous rivers arising in the Pennines flow through the area, generally west to east, but often diverted by the escarpments into more north/south courses.

Source: Coal Measures Natural Area Profile, Nottinghamshire, Derbyshire and Yorkshire Coalfield Countryside Character Area description

2.3 Bedrock geology

The geology of the area is Carboniferous Coal Measures of the Westphalian series, which form a complex layered geology, dipping to the east. Changes in the hardness of the different layers have created a series of relatively gentle escarpments, rising sharply on the west and sloping more gently to the east. Rivers form broad valleys, often overlooked by escarpments to the east. Significant seams of coal, ironstone and fireclay have been worked commercially in the past, although little current exploitation occurs. A breakdown of the solid geology as a proportion of the total land area is: 38 per cent sandstones and 59 per cent mudstones, siltstones and sandstone.

Source: Coal Measures Natural Area Profile, Nottinghamshire, Derbyshire and Yorkshire Coalfield Countryside Character Area description

2.4 Superficial deposits

Superficial geology is dominated by alluvial soils in the broad river valleys. Glacial till deposits are found in the north of the NCA around Leeds and Bradford.

Source: Coal Measures Natural Area Profile, Nottinghamshire, Derbyshire and Yorkshire Coalfield Countryside Character Area description

2.5 Designated geological sites

Tier	Designation	Number
National	Geological Site of Special Scientific Interest (SSSI)	8
National	Mixed Interest SSSIs	0
Local	Local Geological Sites	28

Source: Natural England (2011)

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

2.6 Soils and Agricultural Land Classification

The soils are generally good, with most of the available land in the north of the NCA of Grade 3 (44 per cent of the total area). Between Sheffield and Nottingham there are extensive stretches of Grade 4 land (23 per cent). Small stretches of the area between Leeds, Wakefield and Castleford are Grade 2 (just 1 per cent). Thirty per cent of the NCA (53,000 ha) is under urban or other land uses.

Source: Natural England (2010)

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

Agricultural Land Classification	Area (ha)	Percentage of NCA
Grade 1	n/a	n/a
Grade 2	2,425	1
Grade 3	75,010	44
Grade 4	39,316	23
Grade 5	1	<1
Non-agricultural	2,387	1
Urban	50,614	30

Source: Natural England (2010)

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

3. Key waterbodies and catchments

3.1 Major rivers/canals

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

Name	Length in NCA (km)
Rother	43
Calder and Hebble navigation	39
Aire	37
Dearne	33
Calder	31
Don	23
Erewash	22
Leeds and Liverpool Canal	21
Aire and Calder navigation	16
Erewash Canal	12
Went	7
Nottingham Canal	7
Chesterfield Canal	6

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.

Several major rivers flow in wide valleys from west to east through this NCA, notably the Aire, Calder, Dearne, Don and Rother, to eventually flow into the Humber Estuary. Outside the urban areas, where rivers flow within more natural river valleys, habitat restoration work has been undertaken which provide important areas of interlinking wetland sites such as those found within the Aire and Dearne Valleys. In the south of the area, the Erewash flows east and south to join the Trent, which subsequently also flows into the Humber Estuary.

The low ridges run at right angles to the direction of flow, thus creating a characteristic pattern of river valleys which tend to run north / south along the shale / mudstone troughs between the ridges. Streams and rivers follow the valleys until a weak spot in the sandstone is encountered, where they will abruptly change course almost at rights angles to the previous course, until another ridge line is encountered. This characteristic step wise flow and valley / ridge structure results from the underlying geology of the Coal Measures.

The River Rother is deflected to run north, and the River Erewash to run south, by the ridge of Southern Magnesian Limestone that lies to the east of the Coalfield providing important north to south corridors for species migration.

The industrial history of the area gave rise to a large number of canals that transported raw materials and goods, notably the Leeds Liverpool Canal and the Aire and Calder navigation.

3.2 Water quality

The total area of Nitrate Vulnerable Zone is 135,551 ha comprising 80 per cent of the NCA.

Source: Natural England (2010)

3.3 Water Framework Directive

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

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

4. Trees and woodlands

4.1 Total woodland cover

The NCA contains 15,411 ha of woodland, 9 per cent of the total area, of which 3,868 ha is ancient woodland. Two Community Forests cover parts of the NCA. Community Forests were established to demonstrate the contribution of environmental improvement to economic and social regeneration. South Yorkshire Forest Partnership covers 44,244 ha of this NCA (26 per cent), and Greenwood Community Forest covers 6,280 ha (4 per cent). Much planting has taken place over the past decade or more under these initiatives. Appropriate management will be required to help develop a healthy understory in these woodlands and to create some diversity in age and structure.

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

4.2 Distribution and size of woodland and trees in the landscape

There are approximately 6,738 ha of priority woodland habitat, of which the majority is lowland mixed broadleaved woodland.

Pockets of Ancient Semi-Natural Woodland provide, through their well developed ground flora, a refuge for many plant and invertebrate species not found elsewhere in the county.

Woodlands tend to be small and fragmented, and are found on poorer soils or steeper slopes. Often woodlands lie within corridors leading in to urban areas. This proximity, of many small areas of woodland close to urban areas raises some pressure on these habitats from inappropriate recreational use. Appropriate management is necessary to stop degradation of the woodland habitats, ensuring diversity of structure and the retention of deadwood to support important assemblages of invertebrates.

Only 3,868 ha of the woodland is ancient; this represents an important resource both in terms of biodiversity, and, through lack of development in a highly developed NCA, the retention of evidence of earlier uses and activities, for example, coppicing for early smelting of iron.

Source: Natural England (2010)

4.3 Woodland types

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

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

Woodland type	Area (ha)	Percentage of NCA
Broadleaved	12,626	7
Coniferous	1,238	1
Mixed	418	<1
Other	1,129	1

Source: Forestry Commission (2011)

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

Type	Area (ha)	Percentage of NCA
Ancient semi-natural woodland	3,868	2
Planted ancient woodland (PAWS)	n/a	n/a

Source: Natural England (2004)

5. Boundary features and patterns

5.1 Boundary features

Field boundaries vary from thick well-maintained hedges to close cropped or neglected hawthorn hedges and post and wire or post and rail fences.

Source: Nottinghamshire, Derbyshire and Yorkshire Coalfield Countryside Character Area description; Countryside Quality Counts (2003)

5.2 Field patterns

Field size and pattern is highly variable, with few areas of intact field patterns.

Source: Nottinghamshire, Derbyshire and Yorkshire Coalfield Countryside Character Area description; Countryside Quality Counts (2003)

6. Agriculture

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

6.1 Farm type

This is a mixed farming area. All arable and horticulture cropping represents 34 per cent of the holdings and livestock holdings represents 34 per cent. Holdings classed as 'other types' made up almost a quarter of the holdings in 2009. This was

an increase from 18 per cent in 2000. These holdings mainly include those with only horses, with only grass or fodder crops or with only fallow and buildings. Due to the extensive urban areas, only 41 per cent of the total area is cultivated, and there are significant urban fringe issues. There has been a significant drop in dairy holdings; 168 in 2000 down to 93 in 2009.

Source: Agricultural Census, DEFRA (2010)

6.2 Farm size

Farm size is relatively small, with 43 per cent of farms below 20 ha, and 70 per cent below 50 ha. In the last decade, the total number of holdings has decreased from 1,484 in 2000 to 1,343 in 2009. The size distribution has remained much the same, implying that several farms have deregistered.

Source: Agricultural Census, DEFRA (2010)

6.3 Farm ownership

The decrease in owned land seen between 2000 and 2009 (40,013 to 38,079 ha of farmland) is countered by an increase in tenanted land from 28,731ha in 2000 to 30,587 ha in 2009.

2009: Total farm area = 69,736 ha; owned land = 38,079 ha

2000: Total farm area = 69,532 ha; owned land = 40,013 ha

Source: Agricultural Census, DEFRA (2010)

6.4 Land use

In 2009 almost half of the land was put down to grass or was uncropped (49 per cent), with one third cultivated for cereals (34 per cent). This land use pattern has been fairly stable over the past decade, with small increases in oilseeds and other arable crops which may be due to their relative market prices.

Source: Agricultural Census, DEFRA (2010)

6.5 Livestock numbers

In 2009 there were over 58,400 cattle (64,900 in 2000), 35,400 sheep (43,700 in 2000) and 50,300 pigs (79,100 in 2000).The decrease in livestock numbers coupled with no change in the area put down to grass suggests that stocking rates have reduced significantly, or that there is now more grazing for horses and ponies. Increased equine occupation can lead to compressed soils increasing problems of run-off and reduced herb diversity. Overgrazing inhibits meadow development.

Source: Agricultural Census, DEFRA (2010)

6.6 Farm labour

The numbers of principal farmers (1,977 in 2009 down from 2,231 in 2000), full time workers (459 in 2009 down from 621 in 2000) and part time workers (280 in 2009 down from 346 in 2000) have all decreased, indicating a significant reduction in the agricultural workforce and thus in the management of the land. The numbers of managers has increased (84 in 2009, up from 50 in 2000).

Source: Agricultural Census, DEFRA (2010)

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

7. Key habitats and species

7.1 Habitat distribution/coverage

There are few semi-natural habitats within this NCA, and those that do survive tend to be small and scattered, the most frequently occurring being wet woodland along the river valleys.

A breakdown by habitat is included below:

Wet woodland: Wet woodlands within the NCA are most often found in mosaics with a number of other wetland habitats such as fens and reedbeds. Wet woodland is mainly formed on flashes and low-lying ground within the river

valleys as the rivers cross the NCA. Alder and willow (*Salix* spp.) trees are dominant and wet woodland ground flora includes wood millet (*Milium effusum*), dog's mercury (*Mercurialis perennis*) and wood sorrel (*Oxalis acetosella*).

Lowland mixed deciduous woodland: Patches of woodlands with varying representation of oak, birch and yew are common across the NCA. Bluebells provide a blast of colour in spring in woodlands with well-developed ground floras.

Standing open water: There are a number of important open water sites in the NCA. Large areas of open water provide important habitats for wintering wildfowl; Eccup Reservoir supports more than 1 per cent of the British wintering population of goosander. The high water quality, alkaline water supply and base rich puddled clay substrate of the Leeds Liverpool canal together with the relatively fast flow resulting from the canal's large altitudinal range has resulted in a unique aquatic habitat. The canal supports a diverse aquatic flora including eight pondweed species, one of which is the nationally scarce, hair-like pondweed.

Lowland neutral grassland: Patches of unimproved grassland remain scattered across the NCA with several communities represented dependent upon soils. In the southern part of the NCA there are several patches of haymeadow grasslands with the dominant grasses being sweet vernal grass, common bent, crested dog's-tail, red fescue and Yorkshire fog.

Coastal and flood plain grazing marsh and wetland mosaics: The underlying geology means that there has been heavy mining in this area over the past century. In many areas this has dramatically affected the landscape; a good example can be seen in areas of subsidence where this has resulted in low-lying fields being inundated with water and the establishment of a mosaic of wetland habitats including fens, reedbeds and flood plain grazing marsh. Mickletown Ings is a good example of this and the predominance of certain species at the site is also affected by saline run off from mining spoil providing brackish conditions, with plants such as grey club-rush and saltmarsh rush present. The invertebrate faunas also reflect the brackish water influence and include notably two insects, the long-headed fly and a water beetle *Macroplea mutica* and a number of brackish water crustaceans including the amphipod *Gammarus duebeni* which rarely occurs at inland sites.

Lowland heathland: Lowland heathland can be observed in patches across the coalfields, rather than large tracts of heathland. A good example of the mosaics of heathland and woodland habitats in the local landscape is Seckar Wood SSSI where representative species such as heather (*Calluna vulgaris* and *Erica tetralix*), petty whin, western gorse and crowberry, the latter two species being close to the eastern edge of their range in northern Britain.

Source: Coal Measures Natural Area Profile

7.2 Priority habitats

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

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)	Percentage of NCA
Broadleaved mixed and yew woodland (Broad habitat)	6,738	4
Lowland meadows	539	<1
Fens	258	<1
Coastal and flood plain grazing marsh	215	<1
Lowland dry acid grassland	182	<1
Purple moor grass and rush pasture	168	<1
Reedbeds	164	<1
Lowland heathland	12	<1
Lowland calcareous grassland	7	<1
Upland heathland	7	<1

Source: Natural England (2011)

- Maps showing locations of UK BAP priority habitats are available at: **http://magic.defra.gov.uk** – Select 'Habitats and Species/Habitats'

7.3 Key species and assemblages of species

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

8. Settlement and development patterns

8.1 Settlement pattern

The early settlement pattern is marked by high to very high density of dispersal, with levels of nucleation increasing to the south. Hamlets to the north are typically set around commons and greens and farmsteads along trackways; early hall-church foci of settlements are another distinctive feature of the area. Industrialisation, especially in the late-18th and 19th centuries, led to nucleation and expansion of some settlements. New settlements in the early 20th century developed around coal mines.

Source: Nottinghamshire, Derbyshire and Yorkshire Coalfield Countryside Character Area description; Countryside Quality Counts (2003)

8.2 Main settlements

The main towns and cities within the NCA: Bradford (part) (population 293,717); Leeds (population 443,247); Wakefield (population 76,888); Barnsley (population 71,599); Sheffield (part) (population 439,866); Rotherham (population 117,262). The total estimated population for this NCA (derived from ONS 2001 census data) is: 2,337,669.

Source: Office for National Statistics 2001, Countryside Character Area description; Countryside Quality Counts (2003), Natural England (2012)

8.3 Local vernacular and building materials

There is some survival of early cruck-framed barns. Older buildings were built in local sandstone and Millstone Grit, with very fine municipal architecture in the centres of the cities and older towns, and terrace housing for the workforces. Some 19th and most of the 20th century industrial and urban development, including mining villages, is of brick and slate. There are a

number of open fronted implement/cart sheds with hipped pantiled or stone slate roofs. It is estimated that 60 per cent of listed historic farm buildings remain unconverted, and about 74 per cent are intact structurally.

Source: Nottinghamshire, Derbyshire and Yorkshire Coalfield Countryside Character Area description; Countryside Quality Counts (2003)

9. Key historic sites and features

9.1 Origin of historic features

The heavy urbanisation and industry history within the NCA has led to the loss of much of the evidence of early historical features. Similar to surrounding areas it is expected that clearance of the original forests led, by medieval times, to a landscape of villages, hamlets and individual farmsteads.

Upstanding earthworks are rare but significant for example, Grim's ditch, and a henge on Birkwood common. Prehistoric monuments tend to be better preserved in woodlands here as they were less intensively affected by industrialisation. There are scattered Mesolithic and Neolithic finds along the Don.

Roman roads are preserved but little military or settlement evidence is seen in this area; known sites include Wombwell Wood and Rykneld Street. Little evidence remains of early medieval features. Historical sources suggest Anglo-Saxon settlement at Leeds (possibly Campodunum) and Tanshelf, near Pontefract, and a Saxon settlement has been found at Garforth.

Surviving ridge and furrow, wayside crosses, bridges, medieval granges and monastic houses, for example, Bentley Grange, Myers Wood and Thundercliffe from medieval times, can still be seen. This includes evidence of extensive early coal mining and iron extraction shown by bell pits, some associated with woods and commons such as at Middleton Park, Sharlston. Some coppiced woodland still remains, and several moated sites are known.

Industrialisation in the 18th and 19th centuries led to nucleation of some settlements and development of mills, manufactories, workers' housing and associated infrastructure. Large country estates were built with the wealth generated from industry in the 19th century – some with medieval or Tudor origins – including Bretton Park, Temple Newsam, Nostell Priory, Wentworth Woodhouse and Ravenfield. On the northern edge of the NCA there is an imposing 'model' village at Saltaire, now designated as a World Heritage Site, where mills, canteens, schools, hospitals, civic halls and libraries were built alongside terrace housing for workers. Importation of blue welsh slate for high-status roofs.

Some evidence of the deep mine collieries remains, along with tramways and gin circles. Rivers were exploited for leats, dams, processing buildings and transport. Parliamentary enclosure created a hedged landscape.

To protect the heavy industries in the area during the two world wars in the early 20th century a number of anti-aircraft gun sites were established and some are now scheduled.

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

9.2 Designated historic assets

This NCA contains the following numbers of designated heritage assets:

- 34 Registered Parks and Gardens covering 3,107 ha.
- 1 Registered Battlefield covering 100 ha.
- 158 Scheduled Monuments.
- 4,967 Listed Buildings.

Source: Natural England (2010)

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

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

10. Recreation and access

10.1 Public access

- Three per cent of the NCA, 5,849 ha, is classified as being publically accessible.
- There are 2,919 km of public rights of way at a density of 1.7 km per km^2.
- There are no National Trails within the NCA.

Sources: Natural England (2010)

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

Access designation	Area (ha)	Percentage of NCA
National Trust (Accessible all year)	n/a	n/a
Common Land	425	<1
Country Parks	1,068	1
CROW Access Land (Section 4 and 16)	625	<1
CROW Section 15	498	<1
Village Greens	9	<1
Doorstep Greens	23	<1
Forestry Commission Walkers Welcome Grants	2,812	<1
Local Nature Reserves (LNRs)	1,188	1
Millennium Greens	11	<1
Accessible National Nature Reserves (NNRs)	n/a	n/a
Agri-environment Scheme Access	2	<1
Woods for People	3,991	2

Sources: Natural England (2011)

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

11. Experiential qualities

11.1 Tranquillity

Based on the CPRE map of tranquillity (2006) it shows that the high percentage of urban land means that tranquillity is low in this NCA. There are only very small pockets of tranquil areas between the towns and villages.

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

Tranquillity	Score
Highest value within NCA	20
Lowest value within NCA	-96
Mean value within NCA	-29

Sources: CPRE (2006)

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

11.2 Intrusion

The 2007 Intrusion Map (CPRE) shows the extent to which rural landscapes are 'intruded on' from urban development, noise (primarily traffic noise), and other sources of visual and auditory intrusion. This shows that the vast majority of the NCA is either urban or classed as disturbed especially in the north of the NCA where a number of large settlements are close together including Leeds, Wakefield and Bradford. Only two small patches north and south of Skelmanthorpe remain undisturbed.

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

Intrusion category	1960s (%)	1990s (%)	2007 (%)	Percentage change (1960s-2007)
Disturbed	63	73	67	4
Undisturbed	18	8	1	-17
Urban	19	19	32	13

Sources: CPRE (2007)

Notable trends from the 1960s to 2007 are the large increase in urban areas seen in the past few decades and the effect on disturbance in the NCA. Only 1 per cent of the NCA remains classified as undisturbed.

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

12. Data sources

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

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

Supporting document 2: Landscape change

Recent changes and trends

Trees and woodlands

- Only 20 per cent of woodlands are covered by management agreements.
- There are many small woodlands that are important for access and amenity and would benefit from improved management for biodiversity and woodfuel.
- The two community forest partnerships have had a positive impact on woodland cover across areas of the NCA and work continues to increase cover and management.

Boundary features

- Uptake of agri-environment agreements for boundary features for hedge planting and stone wall restoration was low up until 2003 (just 3 per cent of the total boundary length within the NCA).
- In 2011, 748 km of hedgerow were being managed through Environmental Stewardship agreements and hedge management under Entry Level Stewardship should bring further improvements.
- 101 km of stone wall were also in Environmental Stewardship agreements in 2011.
- Improvements can be seen in the rural areas but boundary features are often lost through development or after changes in purpose for land management.

Agriculture

- Changes in the agricultural landscape have slowed. The agricultural census data shows that there were fewer small farms (less than 5 ha) in 2009 than in 2000, although overall farm size is small, with 70 per cent of farms under 50 ha.
- In 2009 the numbers of cattle, sheep and pigs had all declined since 2000. Dairy and pig farming in particular had declined since 2000, with a move towards a wider range of arable crops, although just less than 50 per cent of the farmed land remains under grass or uncropped. This implies that either stocking rates have reduced or, as is more likely, there is more grazing devoted to horses and ponies.
- Within a mixed farming economy, there has been diversification in crops and also, more recently, a perceived increase in horsiculture in urban fringe areas, especially around Nottingham and Wakefield.
- Traditional rhubarb production in the 'rhubarb triangle' between Morley, Rothwell and Wakefield continues and "Yorkshire forced rhubarb" is protected by the European Commission's Protected Food Name scheme.
- In 2009 there were fewer people directly involved in farming, with a decline in numbers of farmers, full and part-time workers and casual / gang workers, and a small rise in numbers of farm managers, since 2000.

Settlement and development

- There is continued expansion of housing and light industry, putting a lot of pressure on the green belt (64 per cent of the area). Many new developments are of standard design and do not reflect local styles or building materials.
- Development patterns have been directly linked to colliery redevelopment sites and major roads and motorways, evidenced in the South Yorkshire local transport plan.
- Shifts in economic activity are evident where spoil heaps and other reclaimed land is being developed for light industry and warehousing, especially where close to motorways.
- There are an increasing number of wind turbines, especially on the higher ground to the west.

Semi-natural habitat

- Only 1 per cent of the area of the NCA is covered by semi-natural habitats (other than woodland) and these are vulnerable to continued fragmentation.
- The most extensive agri-environment agreements between 1999 and 2003 were for lowland pastures on neutral / acid soils and lowland hay meadows. However, given the overall size of the area this was a limited amount.
- Extensive areas originally affected by deep coal mining and other industry, creating complexes of brownfield sites, spoil heaps and subsidence flashes, have recently been restored and brought under management, often for grazing and tree planting. Substantial sites now address biodiversity, access and enjoyment, as well as flood management issues, such as the Dearne Valley and the Aire Valley between Rothwell and Castleford.

Historic features

- There is limited information available for historic features; however Countryside Quality Counts data suggests that the character of important features of the historic environment were continuing to weaken slowly.
- Many parklands are now being managed as tourism businesses, with accompanying increases in facilities and activities, but with possible dilution of historic character.
- The Heritage at Risk register indicates that there are currently 128 designated monuments at risk in the NCA.
- Some historic features are maintained and advertised as tourist attractions, for example the mine and its infrastructure at the National Mining Museum in Wakefield.

Rivers

- Well into the 20th century many watercourses were channelled and controlled as industry and settlements expanded across the area, giving rise to issues of managing flows and holding water back to prevent flooding downstream.
- Water quality has improved greatly since the decline of industrialisation in the area; developments are very close to the rivers in urban areas and run-off can continue to be an issue.

Minerals

- There continues to be a demand for coal, sandstone, limestone, sand and gravel.
- Coal resources are still available for extraction by open cast mining with new sites continuing to be explored and old sites revisited.
- Restoration of mineral sites has provided new opportunities for geodiversity, biodiversity and recreation over the past decade with areas such as Old Moor RSPB Nature Reserve now well established.

Drivers of change

Climate change

- Increased flooding in river valleys, notably the rivers Don, Rother, Aire and Calder and increased 'flashiness' of flows hence increasing need for flood storage areas outside of urban areas. In the urban areas of Leeds, Wakefield, Bradford and Rotherham there are measures in place to maintain or increase flood defences to reduce flood risk.
- Summer droughts may lead to an increase in water demand for crop irrigation.
- Warmer winters may lead to increased tree growth, and the introduction of new non-native species.
- A longer growing season will potentially lead to double cropping in arable areas, while a warmer climate may lead to the use of new crops.
- Changes in climate will result in species migration and further pressure on and loss of small or isolated habitats.
- A requirement for increasing renewable energy generation is already resulting in an increase demand for wind turbines and biomass growth.
- Previous regional strategies identified the need to encourage planting for biomass around Barnsley and Rotherham.
- Increases in summer temperatures may be higher in urban areas due to the urban heat island effect.
- Climate change may lead to an increase in the instability of steeper slopes with the potential for increased landslides.

Other key drivers

- An expansion of housing, employment, shopping, leisure, education, health and cultural activities and facilities provision will continue to be provided within many principal towns, such as Leeds, Wakefield, Rotherham, Barnsley and Sheffield. The local authority designation of Green Belt may be significantly challenged here.
- Growth corridors, such as the Lower Aire Valley south of Leeds, and 'Waverley' between Rotherham and Sheffield, will bring development pressures, but also opportunities for incorporating improved green infrastructure, more sustainable public transport links and walking /cycling routes.

- Sustainable urban growth in the Lower Aire Valley, Bradford / Shipley corridor and the Dearne Valley are developing best practice demonstration projects.

- Economic regeneration is a key driver for this NCA, with expansion planned for Wakefield, Barnsley, Rotherham, Sheffield and Chesterfield, offering significant opportunities to integrate green infrastructure into housing development. The relevant City Region Development Programmes are drawing up green infrastructure strategies that identify the role that green infrastructure can play. For instance, Sheffield places a strong emphasis on green infrastructure and the economic, environmental and social benefits it brings. This will be enhanced through increased and enhanced woodland planting in line with the South Yorkshire Forest Plan and the further regeneration of the Upper and Lower Don Valleys and the Dearne Valley.

- The complex mix of farmland, urban areas, industry, river and canal corridors and semi-natural habitats puts pressure on landscape features, but also provides opportunities for local populations to gain access to the natural environment for enjoyment and understanding.

- The NCA is identified as a priority area for woodland restoration and new woodland creation, with the South Yorkshire Community Forest a key player in encouraging new woodland.

- There is a need for improved flood management for most of the main rivers. The rivers Aire and Calder in the north-east and rivers Don and Rother in the south have been identified as key areas for new floodplain woodland.

- There has been a loss of biodiversity interest in the NCA over recent decades. The Lawton Review puts forward recommendations for improving connectivity and resilience of habitats; there are opportunities for enhancement in this way in this NCA as it is a very permeable landscape, with an accommodating landform and many opportunities for improved site management.

Award-winning Clifton Park in the centre of Rotherham, recently restored with Heritage and BIG Lottery Funds.

- Much of the land in central areas is identified as having a high or very high vulnerability to livestock poaching. Poaching leads to surface compaction and waterlogging, increasing the risk of rapid surface run-off as well as threatening valued grassland habitats. Many of the soils can be seasonally waterlogged, and in places agricultural practices have also led to soils in the area (notably in the centre) having a medium or high sensitivity to degradation.

- The current poor performance of the region in terms of recycling and recovery means there is likely to be an increasing need for waste management facilities. There is also a need for an increase in landfill capacity and open cast mining sites are often under demand for waste disposal after extraction of coal has been completed.

- There will be a continued demand for coal (with resources available to be extracted by open-cast mining), sandstone, limestone, sand and gravel. The Yorkshire and Humber aggregate mineral resources map shows resources of sand and gravel in the east of the area as well as areas of sandstone. Quarry restoration schemes often include fishing ponds, which provide opportunities for recreation, but enhancement for biodiversity and geodiversity also needs to be addressed.

- There may be opportunities to generate hydro-power from weirs on the rivers, and solar energy farms towards the south of the area. Biomass is increasingly important as a source of renewable energy, with biomass power plants currently in planning.

- The development of industry close to the riparian habitat can hinder work to improve water quality.

- There is continued pressure for food production associated with a national drive for greater self-sufficiency.

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.

Busk Meadow Park in Shirecliffe, north Sheffield; a popular green space for local residents.

Statement of Environmental Opportunity	Ecosystem service																		
	Food provision	Timber provision	Water availability	Genetic diversity	Biomass energy	Climate regulation	Regulating water quality	Regulating water flow	Regulating soil quality	Regulating soil erosion	Pollination	Pest regulation	Regulating coastal erosion	Sense of place/inspiration	Sense of history	Tranquility	Recreation	Biodiversity	Geodiversity
SEO 1: Restore and enhance existing areas and create new landscapes through the inclusion of woodland and networks of green infrastructure to raise the overall quality of design and location of new developments. Regeneration and restoration of industrial sites should seek to create green infrastructure that links fragments of the natural environment, leading to a functioning network for wildlife and access and recreational amenities for people.	o **	↗ ***	↗ **	n/a	↗ **	↑ ***	↑ ***	↑ ***	o **	o **	↗ *	↗ *	n/a	↑ ***	↗ **	o **	↑ ***	↑ ***	↔ ***
SEO 2: Protect and manage the archaeological and historical environment to safeguard a strong sense of cultural identity and heritage, particularly mining heritage, and use the area's distinctive sense of place to inspire interpretation and new development. Engage local communities with their past by enhancing the early, industrial and mining landscapes through restoration of key features of sites and improving access and interpretation.	↔ *	↔ **	↔ **	n/a	↔ **	↔ **	↔ **	↔ **	↔ **	↔ **	↔ *	↔ *	n/a	↑ ***	↑ ***	*****	↗ ***	↗ **	↑ ***

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

Dark plum = national importance; mid plum = regional importance; light plum = local importance

Statement of Environmental Opportunity	Ecosystem service																		
	Food provision	Timber provision	Water availability	Genetic diversity	Biomass energy	Climate regulation	Regulating water quality	Regulating water flow	Regulating soil quality	Regulating soil erosion	Pollination	Pest regulation	Regulating coastal erosion	Sense of place/inspiration	Sense of history	Tranquility	Recreation	Biodiversity	Geodiversity
SEO 3: Conserve, enhance and expand areas and corridors of semi-natural habitat such as grasslands and woodlands to create a functioning ecological network that links the fragmented patches of habitats through urban and sustainably farmed environments, thus assisting species and habitat adaptation to climate change, reducing soil erosion and diffuse pollution.	o **	↗ ***	↗ **	n/a	↗ **	↑ ***	↑ ***	↑ ***	o **	o **	↗ *	↗ *	n/a	↑ ***	↗ **	o **	↑ ***	↑ ***	↑ ***	↔ ***
SEO 4: Manage, enhance and extend wetland habitats associated with the rivers Aire, Calder, Dearne, Don, Rother and Erewash and their tributaries to increase the landscape's ability to naturally and sustainably manage flooding, improve water quality, and increase the resilience of these habitats, the riverine landscape and associated species to climate change.	↔ **	↗ **	↗ ***	n/a	↗ **	↑ ***	↑ ***	↑ ***	↗ **	↗ **	↗ *	↗ *	n/a	↗ ***	o **	↗ **	↗ **	↑ ***	↔ **

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

Dark plum = national importance; mid plum = regional importance; light plum = local importance

Landscape attributes

Landscape attribute	Justification for selection
A generally low-lying landscape of rolling ridges with large rivers running through broad valleys.	■ Underlying Coal Measures geology has significantly affected the landscape form with local variations in landscape character reflecting variations in the underlying geology. ■ Rounded sandstone escarpments stand above mud-floored valleys. ■ Mills and factories tended to follow watercourses along the valleys while the underlying coal gave rise to a very active mining industry.
Underlying geology providing availability of resources (notably water power and iron ore as well as coal).	■ Strong cultural identity arising from the history of industry, particularly coal mining and steel making. ■ This continues to be a source of significant local changes in landscape as new extraction sites become active and old sites are restored. ■ Mining subsidence flashes, restored spoil heaps and open cast mining sites provide opportunities for habitat creation and recreation. ■ Small-scale sandstone quarries provide opportunities for the local restoration of vernacular buildings.

Landscape attribute	Justification for selection
Fragmented landscape with remnants of pre-industrial landscapes and semi-natural habitats.	■ Brownfield sites, woodlands, heathlands, river valley habitats and mining subsidence flashes throughout the landscape, with field boundaries of clipped hedges or fences. ■ Heavy development in river valleys means populations are near to natural resources providing opportunities for access to, and engagement with, the natural environment by large urban communities. ■ Only 3 per cent of the NCA is priority habitat and there is only one internationally designated site within the NCA, increasing the importance of remnant patches of semi-natural habitats for biodiversity. ■ Tree cover is fragmented and made up of a framework of hedgerow trees and small woods together with more extensive woodlands on the steeper valley slopes. The impression of a more wooded landscape is apparent in some areas. ■ Although the centre of this NCA is rural in character it is still significantly influenced by the surrounding urban areas, with the presence of transport infrastructure, residential areas, industry and quarries.
Widespread features of industrial heritage such as mills, goits, tips and old transport infrastructure (such as canals and bridges) still evident, along with more recent mining villages.	■ Industrial buildings remain significant landmarks and focal points. ■ Mining villages such as Goldthorpe (the last pit to close in Barnsley) retain their character and identity. ■ The legacy of wealthy industrialists is visible within town and city centres through the grandiose 19th-century architecture evident in civic buildings such as churches, museums, galleries and civic centres, and in the countryside through their large country houses and associated parks and estates. ■ There are 4,967 listed buildings. ■ The landscape is rich in industrial archaeology, including features such as bell pits, mills and goits, tips, old railways and tramways, canals and bridges, used to tell the story of mining at sites such as the National Mining Museum in Overton, Wakefield. ■ Many of the woodlands have strong industrial links with oak having been managed for pit-props or bark for the tanning industry and sycamore to provide bobbins.

Landscape attribute	Justification for selection
Many large country houses and estates create focal points within the landscape.	■ Established by wealthy industrialists in the 18th and 19th centuries. ■ Feelings of inspiration and escapism are likely to be associated with the reservoirs around Leeds and the large imposing country houses, parks and estates to be found through the area for example Wentworth Castle (a Grade 1 listed Park), Wentworth Woodhouse, Cannon Hall, Bretton Hall and Nostell Priory. ■ There are 34 registered parks and gardens, including several large cemeteries, within the major urban areas ■ Many of these now provide opportunities for access and recreation.
Widespread influence of transport routes, including canals, roads (M1, M62) and railways.	■ The dense network of roads along with major transport routes such as the M1, M62 and the main railways, all contribute to the urbanisation of the area with ribbon developments emphasising the urban influence in the landscape. ■ Opportunities for greater blue and green infrastructure linkage and provision. ■ These linear corridors can play a role in both aiding and preventing species migration through their design and delivery on the ground.
The Trans Pennine Trail and Ebor Way long distance routes pass through the area.	■ A relatively high density of public rights of way, in an area with extensive built-up areas, creates opportunities for local populations to access the natural environment and its cultural heritage ■ The NCA offers a network of rights of way totalling 2,920 km at a density of just over 1.7 km per km2 including the Trans Pennine Trail and Ebor Way long distance routes. There are also small areas of open access land covering 508 ha, or just 0.3 per cent of the NCA, and areas of open space resulting from the restoration of past mineral workings. ■ Registered Parks and Gardens, accessible woodlands and country parks also provide opportunities for recreation ■ The reservoirs of Leeds (the Eccup and Ardsley) are an important recreational resource providing walking, running and cycling circuits close to where people live as well as being important for angling and wildlife.

Landscape opportunities

- Protect the evidence of the industrial era, retaining key and iconic buildings. Plan to encourage development that does not detract from these buildings and their settings.
- Protect cultural links with the industrial past and enhance public understanding of the effects on the landscape today, retaining some industrial features including spoil tips.
- Protect existing fragmented semi-natural habitats and plan to better manage, buffer, expand and link these habitats where possible. Plan improved connectivity between habitats.
- Manage woodlands more appropriately to accommodate wildlife and access. Plan to increase woodland within the NCA especially where it can help improve local landscape and contribute to biodiversity.
- Manage agricultural areas to protect and maintain watercourses, historic ground features, hedges, hedgerow trees and other habitats. Plan to restore boundary hedgerows.
- Manage development so that evidence of different periods of history, including early industrial sites, are retained and conserved.
- Maintain and manage a strong network of public rights of way to link people to the natural environment, encouraging sustainable transport and more access to the environment particularly in areas where there are poor health indices.
- Aim to increase green infrastructure provision in the area that will contribute to biodiversity and provide opportunities for enjoyment of the natural environment, particularly where this can be delivered close to where people live.
- Plan to create and link wetland habitats in river valleys, to strengthen landscape character and enhance biodiversity, and to improve connectivity for species.
- Manage and plan the restoration of unimproved grassland and species-rich grasslands that are more commonly found in the south of the NCA.

Ecosystem service analysis

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

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

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Food provision	Arable and horticulture Livestock Soils	44 per cent Grade 3 soils, 23 per cent Grade 4 soils. Mixed farming with arable and horticulture cropping on 34 per cent of holdings, livestock on 34 per cent of holdings and the other areas accounting for horsiculture, fallow crops and buildings.	Regional	Over 50 per cent of the NCA is developed and development pressure exists for more housing and employment sites reducing land available for food production, particularly around the urban fringe. Numbers of cattle, sheep and pigs have declined in recent years in this area with more grazing being given over to horses and ponies. In mixed farming areas there has been diversification in crop production. Flood management within developed areas and across the valleys to protect properties may impact upon land available to produce food. Increased storm events during summer months may lead to crop losses within the floodplain. Many areas around the urban fringe show signs of neglect and are not utilised for food production. There may be opportunities to promote and support bringing food production back into these areas improving sense of place and the quality of the landscape in these areas.	Seek opportunities to expand food production sustainably within neglected areas. Retain rural areas for food production and to retain separation of settlements by agricultural land. Encourage the restoration and management of field boundaries to improve the character of the agricultural areas. Identify appropriate new production opportunities and adapt management practices to respond to changes in climate and flood risk such as timing of agricultural practices and crop choices.	**Food provision** **Biodiversity** **Sense of place / inspiration** **Regulating soil erosion** **Regulating soil quality**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Timber provision	Broadleaved woodland	Woodlands in the NCA tend to be small and fragmented, often on steep valley sides where they are less vulnerable to either grazing or development pressure. Total woodland cover is 9 per cent of the NCA with 2 per cent consisting of ancient semi-natural woodland. There is little in the way of commercial timber production. South Yorkshire and Greenwood Community Forests are within the NCA.	Local	Historically the woodlands were important for timber provision to support the local industries as well as providing fuel for local use. This local supply chain does not exist to this level any more. Many of the small woodlands lack adequate management and there may be opportunities to bring these woodlands under sustainable management that would support a small-scale local timber crop. Increased tree planting within and close to developed areas can help regulate temperatures and reduce water runoff to help communities adapt and mitigate the effects of climate change. Tree planting can also assist with assimilating new development into the landscape.	Encourage better management of woodlands to increase timber production as well as enhance biodiversity and ensure the long term survival of woodlands. Seek opportunities to enhance woodlands for multiple purposes, whilst increasing production of timber, in particular for woodfuel for local use.	**Timber provision** **Biodiversity** **Climate regulation** **Biomass energy** **Regulating water flow** **Sense of place** **Regulating soil quality** **Regulating soil erosion**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Water availability	Rivers Reservoirs Two small aquifers Ponds	Several major rivers cross the area, including the Don, Aire, Calder, Dearne, Rother and Erewash. In the north, surface water resources including the rivers Aire and Calder have 'water available'[6], as do the rivers Rother, Don, and Dearne in the middle (north of Barnsley to south of Chesterfield), and the River Erewash in the south[7]. This NCA does not overlie any major aquifer. However, the north of the NCA around Bradford and Leeds overlies a minor Millstone Grit aquifer which has 'water available'[8], while the middle of the NCA overlies a minor Coal Measures aquifer which also has 'water available' for further abstraction[9]. There are a few large reservoirs, notably the Eccup and Ardsley Reservoirs on the fringes of Leeds; and the Wintersett Reservoir near Wakefield. Small farm ponds can play an important role locally to provide water for agriculture.	Regional	The large urban populations and areas are reliant on large aquifers in other NCAs to support increased housing and economic development. Ings are common in old mining areas due to subsidence and water levels within these sites are important in maintaining favourable habitat condition. In some areas, such as the Lower Aire Valley, flood banks are artificially maintained to protect farmland and communities. There are opportunities for farms to create ponds to increase their own water available for agricultural purposes.	Increase areas of semi-natural habitat within developed areas and in the countryside to increase water infiltration and reduce run-off. In particular increase permanent grassland areas within the floodplains.	**Water availability** **Regulating water quality** **Climate regulation** **Biodiversity**

[6] *The Aire and Calder Catchment Abstraction Management Strategy*, Environment Agency (2007) [7] *The Don and Rother Catchment Abstraction Management Strategy*, Environment Agency (2003)
[8] *The Aire and Calder Catchment Abstraction Management Strategy*, Environment Agency (2007) [9] *The Don and Rother Catchment Abstraction Management Strategy*, Environment Agency (2003)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Genetic diversity	Not key to this NCA					
Biomass energy	Woodlands	Woodland cover in the NCA is 15,411 ha or 9 per cent of the area. Currently low biomass production in this area. Woodland is found in scattered small patches higher in frequency around Leeds and to the north of Sheffield and Rotherham.	Local	The existing woodland cover in this NCA offers some potential for the provision of biomass by bringing unmanaged woodland under management. The large communities provide a potential high local demand for biomass energy such as for wood-fired boilers in schools. There is generally a medium potential yield for miscanthus in the NCA, with a high potential yield around Rotherham and Leeds. There is a medium potential yield for short rotation coppice, with a low potential yield around Sheffield. A number of biomass plants are in the planning stage and may increase the need to supply more local biomass products. There is limited space for new and large plantations because the use of existing land is dominated by development and farming.	Seek opportunities to improve management of woodlands to make them more productive and retain traditional skills at a local level. Seek opportunities to increase miscanthus production in areas where there is a local need for the product and it does not detract from the provision of other services.	**Biomass energy** **Biodiversity** **Climate regulation** **Regulating water flow** **Regulating soil quality** **Regulating soil erosion**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation	Soils Semi-natural habitats including grassland, heathland, wetland and woodland	The majority of the NCA has a low soil carbon content of 0-5 per cent[10]. Carbon content is likely to be higher under the more than 15,000 ha of woodland (9 per cent of the NCA area), which will also continue to sequester carbon from the atmosphere. Soil carbon content is also likely to be higher under the more than 1,200ha of lowland meadow, semi-natural grassland, heathland and wetland in the NCA. The long history of mining will have lead to damage to the soil structure and top soil, but this may slowly be improving again through restoration work to grassland and woodland.	Local	There is high pressure on the areas of semi natural habitat within the NCA from development. Many areas of semi-natural habitat are not managed, or are managed inappropriately because of their small and patchy distribution. This reduces their ability to sequester carbon. In agricultural areas management measures can be incorporated to increase carbon sequestration and storage. Semi natural habitats also provide an important service in regulating temperature within developed areas. Increasing green infrastructure in developments will help future inhabitants adapt to climate change. **Continued on next page...**	Protect areas of semi-natural habitats such as lowland meadows, heathlands, wetlands and woodlands. Seek opportunities to better manage areas of grassland and woodland and expand them where possible to increase their carbon sequestration and storage. Seek opportunities to include areas of semi-natural habitats in new developments and retrofit into developed areas. In particular look to improve the grassland and woodland networks within these areas. Expand areas of woodland around settlement fringes, on restored mining sites and on parcels of derelict land and along and between developments.	**Regulating water quality** **Biodiversity** **Biomass energy** **Water availability** **Regulating soil erosion** **Regulating soil quality**

[10] *NSRI National Soils Map for England and Wales,* Environment Agency (2009)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Climate regulation				**...continued from previous page** Many of the large cities industrial past means they have a history of large parks and cemeteries within the urban environment and this should be encouraged to help reduce the urban heat island effect in the future and reduce flood risk during storm events. Increased tree planting within and close to developed areas helps sequester carbon and help communities to adapt to and mitigate the effects of climate change. Tree planting can also assist with assimilating new development into the landscape. Soils can be managed through sustainable agricultural practices which protect and bind the soil (such as the management of hedgerows, good grazing regimes and minimal tillage where soils are suitable) to help them retain their soil carbon levels. Restoring soil structure on post-industrial sites and the opportunity for increased organic and carbon dioxide deposition in restored land would be a contribution to climate regulation, although probably only of local significance.	Seek long term management of restored mining sites. Seek to provide areas of semi-natural habitat that supports local habitat networks and provide recreation opportunities for the local population through restoration plans of currently worked mining sites.	

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality	Rivers Aquifers Areas of semi natural habitat Hedgerows and woodland	80 per cent of the area falls within a nitrate vulnerable zone. The ecological status of surface water bodies (or ecological potential in the case of artificial or heavily modified water bodies) is generally 'moderate'; however, there is considerable variation from 'good' to 'poor' across the NCA. The chemical status of surface water bodies in the NCA generally 'does not require assessment'; but there are some river reaches with 'poor' water quality, including around Sheffield and Leeds. The chemical status of groundwater across the NCA is 'poor'[11]. Around Sheffield and Rotherham, the rivers Don and Rother are heavily urbanised. The former takes a large volume of treated effluent from Blackburn Meadows Waste Water Treatment Works (WWTW) in Sheffield while the latter takes treated effluent from the Whittington WWTW in Chesterfield[12].	Regional	Most of the rivers running through the NCA feed into the Humber Estuary passing through densely developed areas and agricultural areas in the Coalfield. Where run off is high, it can impact on water quality further down the river system. Due to the large urbanised area in the NCA water runoff into the waterways can contain pollutants and chemicals. Flash flooding and subsequent run off are exacerbated by the extensive hard surfaces and lack of drainage. Incorporating sustainable drainage systems, including swales and semi-natural habitats in the urban areas, would help hold up water and improve infiltration rates during storm events and heavy rainfall, reducing the amount of pollution entering the waterways. **Continued on next page...**	Seek opportunities to increase areas of semi-natural habitats, especially within developed areas and as buffer strips along water courses to reduce pollution run off. Promote the use and management of sustainable urban drainage systems in developed areas and in new developments in urban and urban fringe areas, making the most of the opportunity to create habitats such as species-rich grasslands and woodlands. Seek opportunities in rural areas to provide buffer strips around areas of high nutrient input. Encourage farmers to manage nutrient inputs more carefully so that they match needs. Maintain and restore hedgerows across slopes within river catchments to bind the soil and reduce run off. Work with farmers across the catchment, to improve soil quality to reduce runoff, and fence water courses to prevent excessive poaching of the river bank by livestock.	**Regulating water quality** **Biodiversity** **Climate regulation** **Regulating water flow** **Regulating soil erosion** **Regulating soil quality**

[11] *Humber River Basin Management Plan, Annex A: Current state of waters,* Environment Agency (2009)

[12] *Don Catchment Flood Management Plan,* Environment Agency (2011)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water quality		Sheffield is a very green city with a high number of parks supported by sustainable urban drainage schemes, tree planting and a number of nature reserves.		**... continued from previous page** The permeability of the freely draining slightly acid loamy soils (23 per cent) may be valuable for aquifer recharge (the minor Millstone Grit and Coal Measures aquifers) requiring the maintenance of good structural conditions to aid water infiltration and the matching of nutrients to needs to prevent pollution of groundwater. Poor water infiltration of some of the soils will increase the risk of sediment and nutrient run-off and flooding. Fast water runoff in storm events can impact on areas both within and outside the NCA. Improved water infiltration in new developments and in rural areas will help ease pressure on the river systems.		

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow	Rivers Wetland habitat and established patches of other semi-natural habitat Sustainable urban drainage, urban parks, trees and nature reserves Woodland and hedgerows	Fluvial flood risk is substantial throughout much of the NCA. In Barnsley, Rotherham, Sheffield and Chesterfield, the top three or four flood peak events since monitoring began have occurred since 2000, indicating the significance of recent flood events. In many locations flood risk is located in urban areas where development has taken place within the floodplain. This is particularly the case in areas such as Chesterfield and south of Sheffield (in Killamarsh and Dronfield)[13]. In the north of the NCA, the River Aire is the source of significant flooding in Horsforth, Leeds and Castleford. There are significant areas of flood risk in the centre of Leeds, where the River Aire and its tributaries are heavily modified and riverside development is of high value. Downstream of Leeds, large areas around Castleford are also at risk of fluvial flooding, and this is exacerbated where the River Calder joins the Aire.	Regional	This NCA has a number of major rivers that run through it for part of their course and flood management is often dependent upon actions outside of the NCA in upper reaches of the rivers such as in the Southern Pennines and Yorkshire Dales. This also means that actions in this NCA can have large impacts on water flow further downstream in other NCAs. Many waterways have been canalised to pass through urban areas and development up to the water's edge reduces the ability to re-naturalise the waterways in these areas. This puts increased pressure on rural areas for land to be used for water storage during times of heavy rainfall, which can impact on the productivity of these areas and their ability to produce food and other resources. Increasing semi-natural habitats within the NCA could help alleviate the speed of run-off from developed and agricultural land. **Continued on next page...**	Seek opportunities to increase semi-natural habitats to help slow down the volume of water entering the river system during and after periods of heavy rain. This has been trialled upstream of major settlements such as in the upper Aire Valley to help slow flood waters arriving in Leeds. In particular the rivers Aire, Calder, Don and Rother have been identified as key areas for new floodplain woodland. There are opportunities within rural areas to improve hedgerow density and increase woodland planting to reduce water flow. Promote sustainable urban drainage systems (SUDS) in new development to increase use of semi-natural habitats and permeable surfacing to reduce run-off and increase water filtration; slowing water entering the system.	**Climate regulation** **Regulating water quality** **Regulating soil quality** **Food production** **Regulating soil erosion**

[13] *Don Catchment Flood Management Plan,* Environment Agency (2010)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating water flow		Extensive washlands north of Castleford are designed to reduce the threat of flooding in the town, as well as to protect arable land further downstream (outside the NCA). In Wakefield, the numbers of properties at risk of fluvial flooding are small, but the probability is high with impacts upon critical infrastructure, including the District Hospital[14]. Around Barnsley there are significant areas of land at risk of flooding from the rivers Dearne and Dove, but this is mostly agricultural land (for example south of Darton and west of Dearne). Large areas surrounding the M18 near Rotherham and the centre of Sheffield are at 'significant' risk of flooding[15] from the River Don, as illustrated by the floods in Sheffield in June 2007, the worst flood in this area in the last 150 years.		**... continued from previous page** Large areas of flood plain storage have been developed in the Aire Valley representing good flood management practice.	Protect and increase urban street trees and green spaces to aid interception and infiltration of rain water and slow run-off. Seek opportunities to allow rivers to follow more natural courses where possible to relieve water flow in the system. Seek opportunities to expand washlands and water storage in floodplains. Improve soil quality to increase water retention and reduce run-off, especially on areas of derelict and post industrial land. Seek opportunities to manage the soil to increase percolation and reduce run-off such as use of cover crops.	

[14] *Aire Catchment Flood Management Plan,* Environment Agency (2010)
[15] *Don Catchment Flood Management Plan*, Environment Agency (2010)

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil quality	Semi-natural vegetation cover, permanent grassland Woodlands and hedges Soils	Slowly permeable, seasonally wet acid loamy and clayey soils cover 58 per cent of the NCA, freely draining slightly acid loamy soils cover 23 per cent.	Regional	The slowly permeable, seasonally wet acid loamy and clayey soils are liable to cause diffuse pollution and flooding as a result of poor rainwater infiltration, and are easily damaged when wet. These soils may have limited potential for increasing organic matter levels by management interventions, as do the freely draining slightly acid loamy soils. They are easily compacted by machinery or livestock if accessed when wet, increasing the risk of soil erosion by surface water run-off, especially on steeper slopes. For the freely draining, slightly acid loamy soils, this risk is exacerbated where organic matter levels are low after continuous arable cultivation or where soils are compacted.	Seek opportunities to incorporate appropriate management techniques, such as including minimum tillage into farm management to reduce soil compaction. Time agricultural practices appropriately to avoid damage to the soil when it is very wet. Promote appropriate stocking densities to reduce poaching and remove livestock when soils are wet. Support measures which increase the volume of organic matter within worked soil to improve soil structure and conditions for soil fauna, increasing water infiltration.	**Regulating soil quality** **Regulating water quality and flow** **Climate regulation** **Regulating soil erosion**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil erosion	Soils Semi-natural habitat cover and buffer strips Hedgerows and woodland	There are 7 main soilscape types in this area: slowly permeable seasonally wet acid loamy and clayey soils (58 per cent of the NCA), freely draining slightly acid loamy soils (23 per cent), restored soils mostly from quarry and opencast spoil (9 per cent), loamy and clayey floodplain soils with naturally high groundwater (4 per cent), slowly permeable, seasonally wet slightly acid but base-rich loamy and clayey soils (2 per cent), slightly acid loamy and clayey soils with impeded drainage (2 per cent), freely draining lime-rich loamy soils (1 per cent).	Regional	The slowly permeable, seasonally wet acid loamy and clayey soils (58 per cent) are easily damaged when wet, therefore it is important to minimise compaction and / or capping risk which will tend to exacerbate run-off problems. These soils may have limited potential for increasing organic matter levels by management interventions. Just under a quarter of the area has light soils (freely draining slightly acid loamy soils and the freely draining lime-rich soils) that have an enhanced risk of soil erosion on moderately or steeply sloping land when cultivated or bare soil is exposed. These soils also have the potential for wind erosion. Compaction caused by livestock or machinery when wet can increase the risk of soil erosion by surface run-off, especially on steeper slopes. Equally, many of the slightly acid loamy and clayey soils with impeded drainage are prone to capping / slaking, leading to an increased risk of erosion. **Continued on next page...**	Encourage the management of stocking levels and timing of livestock usage to reduce compaction of soils. Increase woodlands and semi natural habitats in steep sloping areas where cropping might result in erosion. Increase woodlands and hedgerows where appropriate to bind the soil and act as a wind break to reduce erosion. Promote the establishment of field margins, permanent grassland habitats and use of winter stubble. Increase the organic matter of soil, including soil on restored landscapes, to improve soil structure, aid infiltration and reduce soil erosion risk. Manage and extend riparian vegetation, hedgerows and trees in floodplain areas to bind and filter out the soils in times of flood.	**Regulating soil erosion** **Regulating soil quality** **Food provision** **Biodiversity** **Regulating water quality** **Regulating water flow**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Regulating soil erosion				**... continued from previous page** The restored soils mostly from mineral workings and coal mining and opencast spoil are highly variable, often left compacted following restoration, and the absence of top soil can make them difficult to manage. Rainfall cannot infiltrate, and they are often subject to drought in summer and very wet in winter. They can be susceptible to erosion due to run-off dependent upon their restoration. Highly variable soils in previously worked areas provide opportunities for colonisation and emergence of previously dormant seed species.		

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Pollination	Semi-natural habitats Species-rich road verges	Grassland and heathland cover 1,100 ha of the NCA, providing limited nectar sources for pollinating insects in this NCA. About a third of farmed land is used for crops.	Local	Semi-natural habitats are currently dotted through the rural and fringe landscape. Increases in semi-natural habitats within the rural areas would provide corridors and habitats for pollinators, such as extension and introduction of buffer strips and improvements to hedgerows. This would result in decreased land for farming but better supported crops in those areas in cultivation. Urban gardens and large parks and country estates do provide a useful nectar resource for pollinators linking to productive areas in the urban fringe.	Seek opportunities to increase nectar provision within the rural areas of the NCA through increases in species-rich road verges and buffer strips around water courses and agricultural land. Seek opportunities to link areas of semi-natural habitats and provide corridors linking urban and rural areas. Increase the diversity and extent of field margins and hedgerows Seek opportunities within large infrastructure developments such as major roads and railways to provide increased habitat for pollinators, as well as opportunities to improve management in other linear features such as canals, rivers and hedgerows.	**Pollination** **Biodiversity** **Food production** **Regulating water quality** **Regulating water flow** **Climate regulation** **Regulating soil quality**
Pest regulation	Semi-natural habitats	Currently limited; mainly small patches	Local	Increasing areas of species-rich grasslands and semi-natural habitats in arable areas will increase habitat for pest regulating species, which have a positive impact on crops and lead to long-term sustainable farming.	Seek opportunities to bring semi-natural habitats under sound management to ensure their resilience and long-term regeneration. Seek to expand priority habitats to create structural diversity to provide food and breeding sites for pest predators.	**Pest regulation** **Food provision** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of place/ inspiration	Industrial cities Mining communities, settlements and heritage landscape features Large parks and estates Grand town halls and centres	A sense of place has arisen from the long exploitation of coal deposits, together with resources of stone, iron and soft water. While most of the mines are now closed, their associated settlements and some spoil heaps are still clearly visible in places. The NCA also contains a number of large country houses, parks and estates, while the main cities and towns have striking centres dominated by grandiose 19th century architecture. The quarrying of sandstone for construction, the extraction of iron ore and coal to manufacture steel and steel artefacts are all factors that have shaped the landscape. Although much of the NCA is still rural in character it is influenced by the surrounding urban areas, with the presence of transport infrastructure, residential areas, railways and more recently, large light industrial units and warehouses, leading to an interesting urban/rural mix.	Regional	The NCA's sense of place is strongly linked to the historical industrial nature of business here with many long standing associations between cities and specific trades such as Leeds and the wool industry and Sheffield being renowned for steel production. As these types of industries modernise, there is a need to retain local pride in the history but also to identify the key characteristics providing inspiration for the future. Sheffield has become known as a green city with a high concentration of parks and open spaces linking directly with the Peak District National Park and is looking to build on this as providing a new sense of place for residents. **Continued on next page...**	Seek opportunities to increase awareness and educate people regarding the strong history of the area. Manage and promote historic houses and gardens and civic buildings in cities that contribute to the NCA's character and tell a story of the former industrial wealth. Seek opportunities to promote and increase transference of traditional skills. Seek opportunities to encourage the large urban populations to engage with the natural environment. Improve the urban fringe through careful design and integration of green infrastructure to bring people closer to the natural environment, linking urban green spaces with the wider countryside and reducing negative impacts from urban activities on the rural area.	**Sense of place/ inspiration** **Sense of history** **Recreation**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of place/ inspiration				**... continued from previous page** There is strong cultural association with the past mining history and local identity is often based on the mining background such as individual mining towns and villages that were developed to support individual pits. When restoring land and seeking to strengthen and enhance landscape character, it is important to retain the industrial heritage. The mix of urban and rural is important to help retain the individual identity of developments and to help maintain access to open space. Regeneration within cities and towns should be sympathetic to the striking historic buildings such as Chesterfield's twisted spire.		

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history	Geodiversity Mining infrastructure such as old railway lines and pit heads Striking civic buildings in towns and cities Historic parks and gardens and country houses	A sense of history is evident in Mesolithic and Neolithic remains, and late iron age/Romano-British settlement with cropmarks of enclosed and unenclosed farmsteads with round houses, and later rectangular houses and minor villas, rectilinear field systems and strip lynchets. Medieval influence includes a high concentration of moated sites, relatively numerous 11th -12th century earthwork castles such as Sandal, Greaseley, Kimberworth and Lowe Hill, and a distinctive pattern of small and irregular fields occurring in places. From the 18th century onwards large-scale industrialisation and the rapid increase in population is evident in industrial archaeology, including features such as bell-pits, mills and goits, tips, factories, railways and tramways, canals and bridges. **Continued on next page...**	National	The variety of features in the landscape are evidence of the strong historical link to the past uses and industries of the area. Many features can be used to help tell the story of the area, for example improving management of woodlands and increasing interpretation about the historical uses of wood for pits and fuel. There is a strong cultural link between communities and the industrial history of the NCA, particularly with coal mining – evident in cultural practices such as active brass bands that would once have been with independent collieries. The wealth of the industrial past is prevalent in the area and the stately homes and their grounds provide opportunities for access and to learn about the local history.	Promote use of traditional materials and local building stone in vernacular buildings in small towns to retain local character. Raise awareness and increase interpretation relating to the local history of the area and the importance of this at a national level. Conserve the character of the mining settlements. Conserve archaeological remains and ensure they are not damaged through agriculture and development.	**Sense of history** **Sense of place / inspiration** **Biodiversity** **Geodiversity** **Recreation**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Sense of history		**... continued from previous page** Many of the woodlands have strong links with industry, especially oak, managed for pit-props or bark for the tanning industry, and sycamore for bobbins. Associated with this industrialisation are the large country houses, parks and estates that were created in the 18th and 19th centuries or developed from medieval deer parks (for example Wentworth Castle, Cannon Hall, Nostell Priory, and Hardwick Hall). Traditional buildings in local sandstone and Millstone Grit survive in the core of the older villages and provide further historical associations. Other historic evidence is the legacy of grand 19th century architecture – town halls, museums, galleries, churches – in towns and city centres, built by wealthy industrialists, along with their large country houses and associated parks and estates in the countryside.				

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Tranquillity	Woodlands and other semi-natural habitats Rivers Urban green spaces including country parks and nature reserves	This NCA has experienced a significant reduction in tranquillity. Undisturbed areas have decreased from 18 per cent in the 1960s to just less than 1 per cent in 2007[16]. This lack of tranquillity results in any areas of semi-natural habitat, both large and small, being highly valued for the relative tranquillity they provide.	Local	There are still some relatively tranquil areas to be found within the NCA, for instance undeveloped areas along the river valleys, the new landscapes of past colliery workings, and urban open spaces. Additional tranquillity is likely to be provided by the grounds of the large country houses, country parks and nature reserves. Providing a wide range of opportunities for people to access a tranquil environment will ease the pressure and reduce numbers at current key sites to ensure that they can remain tranquil.	Maintain access to parklands, country parks and nature reserves to provide opportunities for quiet enjoyment. Within the urban fringe, opportunities should be sought to plant woodlands and shelter belts and ensure any new developments are sensitively designed to reduce visual and infrastructure impact on the green belt areas. Regeneration projects and new developments should seek opportunities to provide additional green spaces for people and ensure their management into the future is such that it retains a sense of tranquillity within the wider environment.	**Tranquillity** **Recreation** **Biodiversity** **Sense of place/ inspiration**

[16] *CPRE Intrusion Map, 2007*

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Recreation	Public rights of way Long distance trails Local Nature Reserves Country houses and estates Registered Parks and Gardens	The NCA offers a network of rights of way totalling 2,920 km at a density of just over 1.7 km per km^2; this includes the Trans Pennine Trail and Ebor Way long distance routes. There is very little open access land, although estates, country houses, country parks and Local Nature Reserves provide significant facilities. The canals and disused railways also form important local access networks, while the reservoirs of Leeds are important recreational resources providing walking, running and cycling circuits close to where people live as well as being important for angling and wildlife.	Local	The large population within the NCA requires access to recreation sites both on a day-to-day basis and for wider usage. It is important to provide green spaces close to where people live to help improve physical and mental health and make these communities more attractive to live in. Local woodlands and the two community forests have generated local interest to increase woodland habitats and access for people. Canals, rivers and disused railway tracks also provide important linking green corridors for people to use for transport and pleasure.	Seek opportunities to increase recreation provision through site restoration and improvements to canals, rivers and old railway lines. Seek opportunities to include green infrastructure in new developments and to take opportunities to retrofit semi-natural habitats into developed areas where people have access to them. Seek opportunities to increase local rights of way between communities and natural features as these links are often missing especially in river valleys of industrialised areas. Seek opportunities for circular routes and easily accessible trails for people of all abilities.	**Recreation** **Sense of place / inspiration** **Biodiversity**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Biodiversity	Woodlands Heathlands Rivers and floodplain habitats Soils	There is one internationally designated site within the NCA, Denby Grange Colliery Ponds SAC covering 18 ha. There are also 25 SSSI within the NCA that covers 375 ha (less than 1 per cent) of the NCA. In 2011, 59 per cent were in favourable condition, 23 per cent were unfavourable recovering, 2 per cent were unfavourable no change and 15 per cent were unfavourable declining.	Local	Designated sites make up only a small percentage of the NCA area. The priority habitats outside of these areas are in patches and are very important for biodiversity. Linking these small patches of habitats will provide opportunities for species movement that will strengthen populations and help biodiversity adapt to climate change. Linear features such as rivers, canals, railways and roads provide opportunities to create corridors to link numerous small patches of habitats and stepping stones.	Seek opportunities to incorporate green infrastructure to create linkages within mosaics of habitats. Ensure existing BAP priority habitats such as woodlands and lowland meadows are under an appropriate management regime and are regularly monitored. Plan to expand and buffer existing sites of semi-natural habitats and seek opportunities to link them with habitat corridors. Improve restoration of mineral sites and management of subsidence flashes to maximise their provision for biodiversity. Maximise the opportunities to engage the population, including significant urban populations, with biodiversity, for example by enhancing the biodiversity value of urban green spaces and actively engaging the local community.	**Biodiversity** **Sense of place / inspiration** **Tranquillity** **Timber provision** **Regulating soil erosion** **Regulating soil quality** **Regulating water quality** **Regulating water flow**

Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	Carboniferous Coal Measures	There are eight geological SSSI in the NCA. Although the working of the Coal Measures through underground mines has reduced there are still opencast sites being worked and new ones being explored in the NCA. Sand and gravel extraction also continue in the NCA.	National	The Lower and Middle Coal Measures contain the once economically important coal seams, together with fireclay and ironstone. The overlying Upper Coal Measures are mainly barren of workable coal seams and are largely composed of mudstones, siltstones and sandstones with thin coal seams. The workings of the Coal Measures and restoration of extraction sites provides opportunities for education and recreation within the NCA. Many of the SSSI reveal geological features as a result of human activity, for example railway cuttings and brickworks, and provide opportunities to improve our understanding of these features through appropriate interpretation and access provision.	Mineral workings provide opportunities for recreation and education for the people interested in the influence of the underlying geology on the history of the area.	**Geodiversity** **Biodiversity** **Sense of place / inspiration** **Sense of history**

Photo credits

Front cover: Gently rolling hills sweep through the NCA which is a mosaic of farmland, woodland and natural habitats, rivers and development. Historical buildings and features are common throughout and are an important part of the landscape as here in Hanging Heaton, Kirklees. © Natural England/John Morrison

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