National Character Area profile:

# 45. Northern Lincolnshire Edge with Coversands

Supporting documents



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# Introduction

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

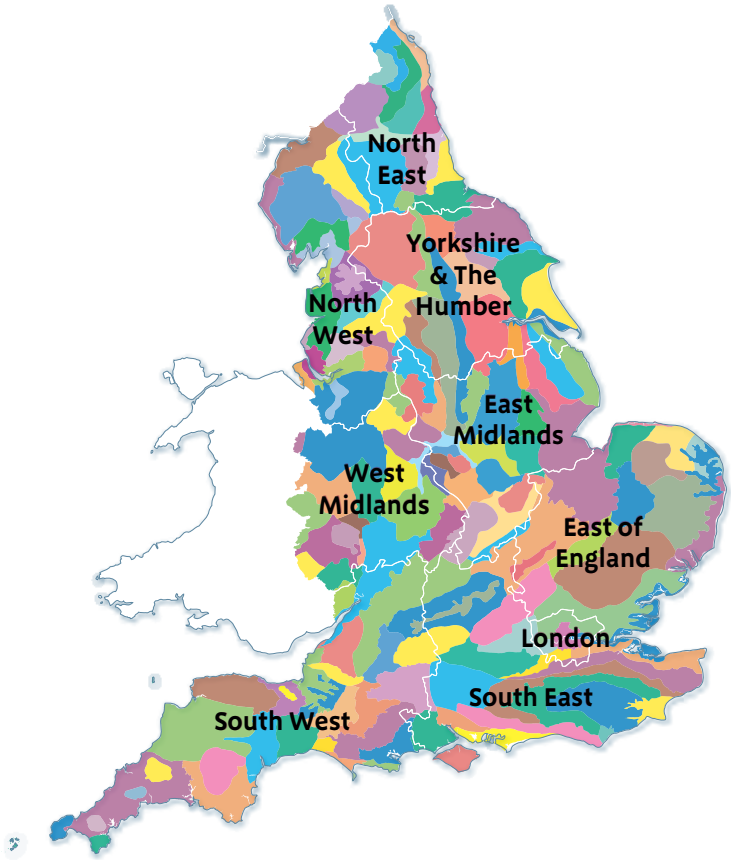
NCA profiles are guidance documents which can help communities to inform their decision-making about the places that they live in and care for. The information they contain will support the planning of conservation initiatives at a landscape scale, inform the delivery of Nature Improvement Areas and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

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

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

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

## National Character Areas map




[1] The Natural Choice: Securing the Value of Nature, Defra (2011; URL: www.official-documents.gov.uk/document/cm80/8082/8082.pdf)

[2] Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services, Defra (2011; URL: www.defra.gov.uk/publications/files/pb13583-biodiversity-strategy-2020-111111.pdf)

[3] European Landscape Convention, Council of Europe (2000; URL: http://conventions.coe.int/Treaty/en/Treaties/Html/176.htm)

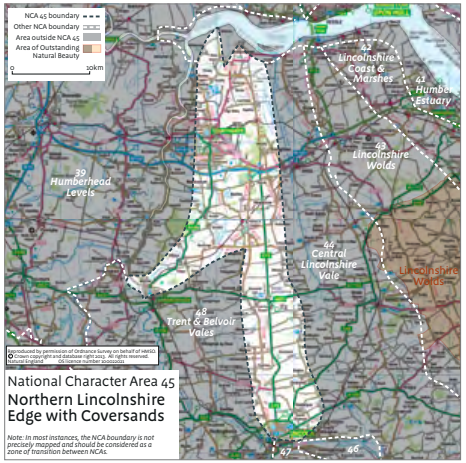
# Summary

The Northern Lincolnshire Edge with Coversands National Character Area (NCA) comprises a ridge of Jurassic limestone running north from Lincoln to the Humber Estuary. The scarp slope rises prominently from adjacent low-lying land, forming the Edge or Cliff, and giving panoramic views out, in particular to the west. In the north is a second, lower scarp of ironstone. In the vicinity of Scunthorpe are the Coversands, post-glacial wind-blown sands which have given rise to mosaics of heathland, acid grassland and oak/birch woodland, supporting rare plant and animal communities akin to the Brecklands. Risby Warren, historically used as a rabbit warren, reveals the distinctive formation of inland dunes. Several of these sandy sites are designated as Sites of Special Scientific Interest, along with a number of disused limestone, ironstone and sand extraction sites, which comprise geological exposures alongside calcareous grassland, open water and other semi-natural habitats. At the northern boundary the limestone drops below the River Humber.

The soils of the limestone plateau are of good agricultural quality and support the cultivation of cereals, oilseeds, root crops and potatoes, along with pig and poultry rearing. Farmsteads of large buildings and sheltering copses are dispersed along the plateau, where there is a sense of openness with large fields and tightly clipped hedges. There are more woodlands in the north of the area, on the sandy soils east of Scunthorpe and on the scarp slopes in the west, and more mixed farming on the lower-lying land to the west, along with further woodlands on sandy deposits. Land on the lower dip slope to the east has been drained and is now productive farmland with fields bounded by ditches.

Ermine Street, a key Roman route from Lincoln to a crossing point on the Humber, follows the higher, drier land of the limestone plateau. Built in Norman times, the magnificent Lincoln Cathedral occupies a commanding position on top of the Edge, and is visible from far around. Exploiting the local ironstone and limestone, a steel making industry developed at Scunthorpe, along with associated engineering and manufacturing. First World War airfields are a feature along the top of the scarp, with RAF Scampton still active and home to the Red Arrows, while other airfields are now used for agriculture or industry and retail.

The Edge forms a watershed between the major catchments of the Trent and Ancholme, both of which flow into the Humber, and the Witham, which flows into The Wash. There is a principal aquifer within the underlying limestone, so that the protection of water quality and improvement of water availability are key issues. While the majority of soils are good quality, they can be prone to erosion, so that measures need to be taken to improve their structure and reduce sediment run-off. The formations and habitats of the Coversands are significant landscape features, and there are opportunities to extend the mosaics of heathland, grassland and woodland.




Click map to enlarge; click again to reduce.

The inland dune systems of the Coversands can be clearly seen at Risby Warren, along with shelterbelts of pines planted in the 20th century. Management of the dry acid grassland requires grazing along with control of weeds such as bracken and ragwort.

## Statements of Environmental Opportunity

- **SEO 1:** On the limestone plateau, manage the high-quality farmland and maintain agricultural productivity, establishing networks of linking habitats to strengthen landscape character and enhance biodiversity, especially farmland birds, while also protecting the underlying aquifer, reducing soil erosion and improving soil and water quality.

- **SEO 2:** On the sandy soils of the Coversands, protect the distinctive dune formations and expand, buffer and connect the key habitats, providing access and interpretation where possible, and addressing climate regulation, soil erosion and water availability.

- **SEO 3:** Maintain the sense of place and the diversity of settlements and landscape features through expanding semi-natural habitats, managing the restoration of extraction sites, retaining the inspirational long views, ensuring that development is sustainable and well integrated into the landscape, and providing more interpretation and access through good green infrastructure links.

- **SEO 4:** Protect and manage sites and features of historic, geological and geomorphological interest, such as sand dune formations and rock exposures, Roman roads, stone walls and vernacular architecture, and Lincoln's historic centre, to strengthen sense of place and history, enhance biodiversity and improve understanding of how the landscape has developed over time.

# Description

## Physical and functional links to other National Character Areas

The Edge, an escarpment formed of Jurassic limestones combined with an escarpment of Lower Jurassic mudstones, rises prominently from the low-lying farmland in the Humberhead Levels and Trent and Belvoir Vales National Character Areas (NCAs) to the west, giving rise to impressive long-distance views. To the east the dip slope drops away to the clays of the Central Lincolnshire Vale NCA, with a number of spring-fed small rivers draining into the heavily modified Ancholme River. The outcrop of limestone forming the Edge extends south into the Southern Lincolnshire Edge NCA, bisected by the River Witham at Lincoln, and giving rise to a similar landscape of good-quality agricultural land. Lincoln Cathedral, built on top of the Edge above the Witham Gap, is a prominent landmark from miles around.

The Edge forms a watershed between three major river catchments. The northern boundary touches the Humber Estuary at Whitton, where the hard limestone dips down below the river and underlies the Yorkshire Wolds NCA to the north. On the western side the River Trent flows north along the foot of the scarp slope, largely within the Humberhead Levels except for a stretch where it flows through Gainsborough, and then joins the Humber below Alkborough. At Lincoln the River Witham cuts through a narrow gap in the limestone and flows south to The Wash. An important aquifer underlies the whole limestone ridge.

Ermine Street, a Roman road which now forms the A15, runs north–south along the Edge, linking Scunthorpe and Lincoln, while the M180 runs east–west, cutting through the Edge south of Scunthorpe and linking the ports and industrial areas of Grimsby and Immingham to their hinterland.

**The magnificent Lincoln Cathedral, built in Norman times, is a prominent landmark, standing high on the Edge above the River Witham.**

## Key characteristics

- Elevated arable landscape with a distinct limestone cliff running north–south, the scarp slope providing extensive long views out to the west.
- Double scarp around Scunthorpe of ironstone, and extensive areas of wind-blown sand, the Coversands, giving rise to infertile soils supporting heathland, acid grassland and oak/birch woodlands, with rare species such as woodlark and grayling butterfly.
- Underlying limestone supporting small areas of calcareous grassland.
- Few watercourses on the plateau, which lies between the rivers Trent and Ancholme which flow into the Humber, and is cut through in the south by the River Witham.
- Productive soils on limestone plateau giving rise to a large-scale landscape of arable cultivation with extensive rectilinear fields and few boundaries of clipped hedges or rubble limestone, supporting birds such as grey partridge and corn bunting.
- Semi-natural habitats of acid and calcareous grassland and broadleaved woodland are small and fragmented, and often associated with disused quarries.
- Limited woodland cover, with patches of both broadleaves and conifers associated with infertile sandy soils, elsewhere occasional shelterbelts.
- Long, straight roads and tracks, often with wide verges; Ermine Street follows the route of a key Roman north–south route.
- Nucleated medieval settlement patterns following major routes, especially Ermine Street; sparse on higher land, with springline villages along the foot of the Cliff and some estates and parklands.
- Other development comprises the major settlements of Lincoln and Scunthorpe, with their prominent landmarks of the cathedral and steelworks, and several active and re-used airfields prominent on the ridgetop.
- Vernacular architecture and walling, especially in villages, of local warm-coloured limestone with dark brown pantiles.
- Several ground features, especially on the plateau, include prehistoric burial mounds, Roman artefacts and abandoned medieval villages.

## Northern Lincolnshire Edge with Coversands today

The Lincolnshire Edge is a distinctive limestone scarp or 'Cliff' running down the length of the area, from Whitton on the Humber Estuary in the north to Lincoln in the south. To the east of Scunthorpe a second scarp of calcareous mudstones and siltstones, including ironstone, forms the western margin of the north part of the NCA. These slopes rise prominently from the flat cultivated lands of the Humberhead Levels and the Trent and Belvoir Vales, forming a distinct wooded edge to these areas. From the top of the Cliff there are impressive panoramic views out over the Humber Estuary, the Levels and the Vales, with several viewpoints, notably at Alkborough and Scampton. The Edge then dips gently to the east, with views out over the clay vale of the River Ancholme, most of which lies within the Central Lincolnshire Vale NCA.

**The plateau, with its good quality, productive land, is typically open, with large fields and few hedges. Farmland birds such as grey partridge, lapwing, corn bunting and yellow wagtail can be found here.**

The fissured nature of the underlying rock means that there are few surface streams. Groundwater percolates into the limestone to emerge as springs where it meets the underlying impermeable mudstones at the foot of the scarp. The Edge forms a watershed between the Trent to the west and the heavily modified Ancholme and its tributaries to the east. To the south the River Witham cuts through the limestone at Lincoln and flows south to The Wash.

On the top of the Edge is a covering of shallow, well-drained, brashy limestone loam soil which gives rise to productive arable cultivation, including cereals, oilseeds, root crops, potatoes and some vegetables, along with pig and poultry rearing. There is only a small amount of mixed farming and generally livestock numbers are low, pigs being the most numerous and usually housed in sheds.

This is a predominantly large-scale arable landscape with occasional shallow dry valleys. Fields are typically large and rectilinear with gappy clipped hedgerows, or rubble limestone in places. Field sizes tend to be smaller around the villages. The dispersed farmsteads are typically large, with courtyard arrangements of barns and sheds that have developed over time, often overshadowing the original stone farmhouse. Copses of mixed-species trees provide some shelter. In places the limestone comes close to the surface, giving rise to small areas of calcareous grassland, which can also be found in a number of disused limestone quarries.

This is a significant area for farmland birds such as grey partridge, lapwing, tree sparrow and corn bunting, and also for hares. Although there are few wetland habitats within the NCA, the lower-lying areas below the scarp to the west, where the River Trent runs through the Humberhead Levels, are important for providing winter feeding and roosting for wildfowl and birds such as curlew, snipe and redshank.

A number of straight roads and trackways, often with wide grassy verges, cross the area; the Roman Ermine Street, now the A15, is the most pronounced, running north from Lincoln to the Humber Estuary.

To the south and east of Scunthorpe are areas of wind-blown sand, the Coversands, which give rise to a very different and distinctive sandy landscape of open heath, acid grassland, and oak and birch woods, with pockets of mire and wet heathland. Once extensive, these heathy areas have been reduced by enclosure and conversion to agricultural land, quarrying for sand or ironstone, or conifer planting. At Risby Warren Site of Special Scientific Interest (SSSI) the original inland sand dune formations can be clearly seen, with mosaics of open sand, extensive lichen heathland, acid and calcareous grassland, and broadleaved scrub, broken up by shelterbelts of pines. These heathlands are distinct from southern or upland heaths, having more affinity with Breckland heathlands. Nationally rare species found here include the woodlark and grayling butterfly. Lichen-rich heathland also occurs on the undulating sandy hills of the Coversands at Messingham Heath, forming mosaics with acid grassland and birch woodland.

There are extensive woodlands near Broughton, including Broughton Far Wood, an SSSI for its ash/oak woodland lying on clay overlying limestone, and Broughton Alder Wood with its spring-fed wet valley dominated by alder trees. On the western boundary, near Laughton, are further extensive woodlands, including plantations, on the sandy soils.

Around and to the north of Scunthorpe the underlying ironstone was exploited and this, along with local limestone and coal from the coalfields to the west, gave rise to an iron and steel industry. Scunthorpe is now characterised by extensive housing and industrial estates, wrapped around the massive sheds, chimneys, lighting columns and other structures of the steelworks. Ironstone workings have been restored, often leaving stretches of open water, scrub and grassland, providing attractive areas for recreation. Sand quarrying continues, while at Messingham Sand Quarry SSSI the workings now form a mix of open water, wetlands, woodland and sandy heathland.

The dip slope of the Edge inclines gently down to the Ancholme Valley where springs give rise to easterly flowing streams draining into the highly modified River Ancholme, which runs close to the eastern boundary; part of the old river course falls within the area. Here, on low-lying land below Appleby and Broughton, the land has been drained and the fields are large and rectilinear, bounded by ditches, creating an open, intensively cultivated landscape.

To the west, below the scarp of the Edge, soils are deeper on the lower-lying land towards Gainsborough, a market town located on the Trent. Here there is more of a sense of enclosure, with pastures bounded by full hedges, several parklands and estates associated with country houses, and woodlands on the steeper slopes of the scarp and on sandy soils around Scotton. A number of attractive small villages, including Kirton in Lindsey, Willoughton, Glentworth and Fillingham, nestle along the springline at the foot of the Cliff. Older houses, walls and farm buildings are often built with the local warm-coloured limestone, with dark brown or red tiled roofs, creating an attractive visual coherence.

The area is punctuated by a number of prominent features, from the massive steelworks at Scunthorpe and the hangars of military airfields along the top of the Edge, to the distinctive and prominent cathedral in Lincoln, standing high up on the Edge overlooking the Witham Gap, where the river cuts through the limestone. On the plateau top, some airfields have been put to new uses, and large buildings constructed for grain storage, light industry, warehousing and retail and communications masts are often very prominent out on the flat open land of the limestone plateau. Several farms now have large rectilinear reservoirs to provide for irrigation of crops on the light soils of the plateau. The restoration of ironstone and sand extraction sites often includes semi-natural habitats as well as agricultural land, while some sand (silica) extraction continues such as at Messingham. Lincoln, with its links to Roman history, its magnificent cathedral and medieval town housing on the slopes below, remains a major tourist destination.

## The landscape through time

The Lincolnshire Edge is a long, prominent ridge, running from Grantham to the Humber Estuary, formed by Middle Jurassic Limestones – the Lincolnshire Limestone Formation. The scarp slope rises sharply from low-lying land to the west, while the dip slope drops gently to the Ancholme Valley in the east. In the northern part of the NCA the presence of resistant Frodingham Ironstone in the early Jurassic Lias Group, forms a very distinct secondary scarp, overlooking the River Trent as it draws close below Alkborough. This ironstone is often rich in fossils, especially ammonites and oysters ('devil's toenails').

**The influence of the Romans in the area is evident through archaeological features and the many long, straight roads that converge on the settlement of Lincoln. Ermine Street, now the busy A15, runs north-south through the area, linking Lincoln with a crossing point on the Humber.**

In places, the bedrock is overlain by glacial deposits of till as well as sands and gavels deposited by glacial meltwater. After the last glacial retreat, the sands were re-worked by wind, covering an extensive area around Scunthorpe with sand dunes. These sands are still evident, and Risby Warren is exceptional as an inland dune system where surface morphology and dune formations can be clearly seen.

There is widespread evidence of early settlement along the Edge, including prehistoric burial mounds and linear boundary features. The legacy of the Romans is more visible, particularly the roads that converge on the fort and later colonia at Lincoln. Ermine Street runs north–south along the full length of the NCA, linking the iron-age and Roman settlement of Lincoln with a boat crossing point on the Humber. Lincoln was located in a strategic and defensive position, at the crossing point of the Witham and junction with Fosse Street, high up on the Edge, with clear views all round. Lincoln Cathedral was built during the Norman period, and evidence of city walls and medieval houses remains on the slopes below the cathedral.

Saxon and medieval settlements arose along the springline below the western scarp, many surviving to form the basis of the current pattern of nucleated villages. The Edge plateau was largely unsettled, providing common pastures for flocks of sheep otherwise folded on the fallow lands below. The linear parishes across the plateau reflect this, aligned east to west on each side of Ermine Street to take advantage of both the open heath and pastures on the tops, and the deeper soils on the eastern side slope and below the western cliff. The lighter soils of the Coversands were used as rabbit warrens. Some medieval villages were depopulated as a result of later agricultural changes, with ground formations still evident, for example at Gainsthorpe and Sawcliffe.

Enclosure of fields took place from the 14th century onwards, the field patterns on the lower land to both the east and west reflecting a more complex history with irregular field systems, and taller and more woody hedgerows. A mix of farm buildings of various periods, especially from the 17th century onwards, form today's large farmsteads. As wealth accumulated, some large country houses with walled estates, parkland and fishing ponds were established, such as at Fillingham.

Drainage of the low-lying Ancholme Valley started in the 17th century, transforming the 'carrs' (marshy land) used for summer grazing into productive farmland drained by a network of ditches. As agricultural techniques developed, the open heaths along the Edge could be productively cultivated, and in the 18th and early 19th centuries they were subdivided by Parliamentary Acts, resulting in large-scale rectilinear fields enclosed by hawthorn hedges or in a few places by limestone rubble walls.

Gainsborough, located at a crossing point of the River Trent and at the upper extent of the tides, originally developed as a port, transferring goods from sea-going vessels to distribute inland. Ironstone and limestone were exploited near Scunthorpe from the 1860s, leading to the development of the iron and steel industry, along with the rapid expansion of the town. Later this industry expanded and extended into manufacturing and engineering works, along with sand extraction. Lincoln city also expanded, with extensive Victorian housing of red brick terraces and town houses, as the arrival of the railway in the 19th century encouraged its development as an engineering centre.

The plateau landscape changed during the 19th and 20th centuries as sheltering copses were planted adjacent to the big farmsteads, and some small plantations were planted on the side slopes for shelter, game and timber. Between the First and Second World Wars conifer plantations were established on the infertile Coversands to the east and south of Scunthorpe, and around Scotton.

Airfields were established on the top of the Edge in the First World War, and these became a core part of Britain's east-facing deployment of bomber bases in the 1930s. Some airfields remain active, used for recreational flying, or for military purposes, as at RAF Scampton. Scampton expanded in the Cold War period as one of a number of V-bomber bases, and is one of the most historically significant military airfields in Britain. It is the home of the 617 Dambuster Squadron and the Red Arrows. Other airfields have been restored to agriculture or redeveloped for grain stores, and industrial and retail use, as at Hemswell Cliff with its complexes of large buildings.

Scunthorpe, characterised by extensive post-Second World War housing, faced the downsizing of heavy industry in the late 20th century, but industrial estates, supported by the construction of the M180 which provides links with the ports to the east and the markets inland, expanded to house light engineering, food production, distribution and retail uses. The mainly arable farms on the Edge flourished during the late 20th century, and this period also saw the construction of irrigation reservoirs and a number of communications masts. Some sand and ironstone quarries are now being used for landfill or have been restored for agricultural or recreational uses, while also supporting important semi-natural habitats.

## Ecosystem services

The Northern Lincolnshire Edge and Coversands 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 Northern Lincolnshire Edge and Coversands NCA is contained in the 'Analysis' section of this document.

### Provisioning services (food, fibre and water supply)

- **Food provision:** With 40 per cent of the land classified as Grade 2 agricultural land, this is a productive area for cereals, oilseeds, root crops, pigs and poultry. Farm holdings and farmsteads are generally big, with large rectilinear fields bounded by clipped hedgerows on the plateau, or ditches on lower-lying land.

- **Timber provision:** There are a number of plantations managed for timber, as well as for game shooting. While there may be some scope for increasing the production of timber, this is likely to be limited due to the extent of good-quality farmland, and where priority is given to restoring or expanding areas of heathland and dry acid grassland on sandy soils.

- **Water availability:** The Edge forms a watershed between the major catchments of the Trent, Ancholme and Witham. There is a significant principal aquifer within the underlying limestone which supplies local industries, domestic users and farms. However, resources are generally fully committed and further demand needs to be controlled to maintain river flows. Several farms have constructed reservoirs to provide water for irrigation. There is scope to improve the capture and infiltration of rainwater, for instance by improving the structural condition of soils, and increasing the area of permanent grassland and woodland.

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

- **Climate regulation:** Most of the soils have a low carbon content, and semi-natural habitats, including woodlands and wetlands, are relatively limited in extent and dispersed. There is some scope for raising the organic content of soils by adopting different cultivation practices, increasing the area of grassland and woodland, and ensuring that existing woodlands are brought into sound management.

- **Regulating water quality:** With the important principal aquifer contained within the underlying limestone bedrock there is a need to ensure that water percolating down is of good quality. The whole area is a nitrate vulnerable zone, and farmers are required to comply with regulations around the application and storage of fertilisers and manures. Measures can be adopted that improve the rate of infiltration of rainwater and reduce sediment and nutrient run-off into watercourses.

- **Regulating soil quality:** Most of the soils are of good agricultural quality. The lime-rich soils over the limestone, while typically shallow and susceptible to drought, have a degree of resilience owing to their calcareous nature. Measures to increase the organic content of soils, and to carefully manage the timing of cultivation activities to avoid compaction, will also assist with climate regulation and reducing soil erosion.

- **Regulating soil erosion:** The majority of the soils in this NCA are prone to erosion, especially when left bare or compacted, or where organic matter levels are low following continuous arable cultivation. There is also a risk of wind erosion on the open plateau. Measures can be taken to increase the organic content, and to establish networks of hedgerows, grass strips and small woodlands to both reduce wind erosion and capture sediment run-off.

### Cultural services (inspiration, education and wellbeing)

- **Sense of place/inspiration:** While a predominantly arable landscape, it has many distinctive features including the scarp slope (the Cliff), the varied habitats of the Coversands, the prominent steelworks at Scunthorpe, historic villages, the airfields and inspirational long-distance views, especially out to the west. In the south is the city of Lincoln with its rich history and inspirational views to and from the cathedral. There is scope for strengthening the fabric of the landscape and for managing further development.

- **Sense of history:** The historic evidence that is most visible is that of the Roman period, with the network of long, straight roads, in particular Ermine Street which links the settlement of Lincoln with the crossing point of the Humber. Other features include the cathedral in Lincoln built by the Normans, deserted medieval villages and, more recently, military airfields and the steelworks that tower above Scunthorpe. There is scope for protecting these features and providing interpretation to bring them to the attention of a wider audience.

- **Recreation:** The Ironstone Walk and the woodlands and heaths of the Coversands provide access for quiet recreation in the Scunthorpe area, as do some restored extraction sites, such as at Messingham. However, elsewhere accessible areas and footpath networks are limited, and there is scope for improving access for walkers, cyclists and horse riders, especially providing links between urban areas and the countryside.

- **Biodiversity:** The Coversands support important mosaics of heathland, akin to those of Breckland, as well as dry acid grassland and oak/birch woodland. Several of these areas are designated as SSSI, along with disused quarries and sand extraction sites, which support calcareous and acid grassland, heathland and broadleaved woodland. Expanding, buffering and connecting the fragmented semi-natural habitats in the area would improve their condition and make them more resilient. Networks of hedgerows and species-rich permanent grass margins could be established within the farmland which would provide connections between semi-natural habitats to enable species movement, as well as supporting pollinating insects.

- **Geodiversity:** The exploitation of limestone, ironstone and sand has given rise to some important exposures in disused quarries, several of which are now designated as SSSI. These include important exposures of limestone stratigraphy, internationally important ammonites and coral fauna. The inland dune formations of the wind-blown Coversands are of particular interest here. There is scope for extending access and interpretation of these many features to improve understanding and increase enjoyment of them.

**Local availability of ironstone and limestone led to the rapid development of a steel industry in Scunthorpe, the structures of the steelworks forming a distinctive landmark in the north of the area, rising above the town.**

# Statements of Environmental Opportunity

**SEO 1: On the limestone plateau, manage the high-quality farmland and maintain agricultural productivity, establishing networks of linking habitats to strengthen landscape character and enhance biodiversity, especially farmland birds, while also protecting the underlying aquifer, reducing soil erosion and improving soil and water quality.**

**For example, by:**

- Working with the farming community to maintain present levels of productivity in this important food producing area and identifying possibilities for improved productivity while ensuring that soils are protected from erosion, water quality is maintained and demands for water are not increased, for instance by introducing crops that are drought resistant.
- Encouraging the uptake of agri-environment schemes, or through voluntary measures, to improve the management of existing hedges, allowing them to fill out and infilling gaps to make them continuous, thus strengthening them as landscape features and as connecting links between semi-natural habitats.
- Working with farmers to identify where hedges with margins of permanent grassland can be restored or introduced on the open limestone plateau, to reduce wind erosion, improve the infiltration of rainwater, capture sediment and nutrient run-off, support pollinating insects and pest predators, and contribute to a network of linking habitats running through the farmland.
- Encouraging farmers, through agri-environment schemes where possible, to establish margins of unfertilised species-rich grassland alongside watercourses, hedgerows and tracks throughout the farmed land to create networks to link semi-natural habitats, thus allowing species movement as well as capturing sediment and nutrient run-off, reducing the speed of surface water run-off, and supporting pollinating insects, farmland birds and other wildlife.
- Encouraging cultivation practices that increase the organic content of soils, such as including green manure and fallow in rotations, direct drilling and increasing the area of permanent grassland, to improve infiltration of rainwater and reduce soil erosion.
- Encouraging farming practices that reduce soil erosion, for instance avoiding cultivation on sloping sites, introducing grass strips or beetle banks across slopes to reduce run-off speed and capture sediment, and increasing the area of permanent grasslands.

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**SEO 1: On the limestone plateau, manage the high-quality farmland and maintain agricultural productivity, establishing networks of linking habitats to strengthen landscape character and enhance biodiversity, especially farmland birds, while also protecting the underlying aquifer, reducing soil erosion and improving soil and water quality.**

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- Ensuring that the timing of cultivation on those soils that are vulnerable to compaction is carefully handled, to avoid capping or other damage, and reducing periods when soils are bare to a minimum.
- Promoting catchment sensitive farming, for instance encouraging farmers to comply with best practice around the application of organic and manufactured manures, including matching rates of fertiliser application to needs as far as possible, and providing adequate storage of livestock manures, to ensure that water quality is not affected.
- Working with farmers to find opportunities to introduce more mixed farming, thus including more managed grassland in rotations, increasing the organic content of soils, providing conditions that are more suitable for a range of farmland birds and wildlife, and enabling conservation grazing where needed.
- Seeking opportunities to allow the tributaries of the River Ancholme to follow more natural courses and spill out into flood storage in the flood plain at times of flood flows.
- Considering the introduction of biomass crops such as miscanthus and short rotation coppice, but reducing the risk of soil erosion by avoiding sloping land and keeping periods of exposed soil to a minimum.
- Seeking opportunities, through agri-environment schemes, to revert arable land to permanent grassland in order to protect archaeological ground features.
- Managing land adjacent to wet woodland and other wetland habitats to buffer them and maintain their hydrology, thus retaining them as landscape features and enhancing their biodiversity interest.
- Ensuring that new irrigation reservoirs are constructed so that they contribute to biodiversity interest and fit into the landform by providing shallow sloping edges so that vegetation can be established, thus ensuring that they make a positive contribution to the local landscape.

**SEO 2: On the sandy soils of the Coversands, protect the distinctive dune formations and expand, buffer and connect the key habitats, providing access and interpretation where possible, and addressing climate regulation, soil erosion and water availability.**

**For example, by:**

- Maintaining and expanding mosaics of heathland with pockets of mire and wet heath, dry acid grassland and oak/birch woodland and introducing management where necessary to improve their biodiversity and their resilience to climate change, while also improving infiltration of rainwater.
- Seeking opportunities to restore areas of heathland and dry acid grassland, especially where these sites will expand and connect existing sites, to buffer them and make them more resilient to climate change.
- Protecting heathland and dry acid grassland through grazing management, re-introducing grazing regimes where necessary, while also protecting significant archaeological sites and controlling scrub and bracken encroachment.
- Seeking opportunities to buffer, extend and connect the sandy soil habitats including lichen heath, lowland heathland and dry acid grassland, and the rare plant and animal species that they support such as woodlark and grayling butterfly, to improve their condition and resilience and enable species movement, as well as supporting pollinating insects and pest predators.
- Ensuring that existing oak/birch woodlands are under sound management that will protect and enhance their biodiversity interest, encouraging natural regeneration of native broadleaved species where possible.
- Seeking opportunities to remove conifer plantations from areas where heathland or dry acid grassland could be restored, finding suitable compensation planting sites elsewhere.
- Protecting the distinctive inland dune formations and other geomorphological features of the wind-blown sand.
- Providing access and interpretation where possible, to improve understanding of the sand dune systems and sandy soils and the particular habitats and species that they support.

**SEO 3: Maintain the sense of place and the diversity of settlements and landscape features through expanding semi-natural habitats, managing the restoration of extraction sites, retaining the inspirational long views, ensuring that development is sustainable and well integrated into the landscape, and providing more interpretation and access through good green infrastructure links.**

**For example, by:**

- Protecting the sense of place and inspiration by ensuring that accessible viewpoints to enjoy the long-distance views across adjacent National Character Areas from the top of the Cliff are retained, and that long-distance views inwards to Lincoln Cathedral are unobstructed.
- Maintaining the open character of the limestone plateau including appropriate redevelopment of disused airfields, re-using their technical and domestic infrastructure and protecting features of historic interest.
- Maintaining locations for visitors to safely watch the Red Arrows practise.
- Maintaining the settlement pattern and the historic character of villages, farmsteads and estates, including through sensitive development and the re-use of redundant buildings.
- Ensuring that the restoration of mineral extraction sites includes the establishment of priority habitats, notably heathland and acid or calcareous grassland, where possible, and introducing management so that the sites make a positive contribution to biodiversity value and to local landscape character, providing access where possible.
- In restoration schemes, ensuring that new open water and wetland habitats are managed to contribute to the local landscape and enhance biodiversity interest, accommodating recreational use where appropriate.

**Ironstone, limestone and sand have all been exploited in this area. At Messingham, the sand quarry has been restored to form a rich mosaic of heathland, grassland and woodland, with some stretches of open water.**

**Continued on next page...**

**SEO 3: Maintain the sense of place and the diversity of settlements and landscape features through expanding semi-natural habitats, managing the restoration of extraction sites, retaining the inspirational long views, ensuring that development is sustainable and well integrated into the landscape, and providing more interpretation and access through good green infrastructure links.**

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- Identifying areas of calcareous grassland and seeking to expand, buffer and connect them, thus making them more resilient to climate change.
- Identifying, maintaining and enhancing the springs and flushes on the edges of the limestone.
- Encouraging the management of the wide road verges to increase structural diversity and species richness, to contribute to a network of linked semi-natural habitats throughout the area, which will support pollinating insects, enhance biodiversity and provide interest for residents, visitors and those passing through the area.
- Restoring ancient woodlands that have been planted up to a more natural composition of native broadleaved species across a wide range of age classes, and managing other woodlands to ensure their long-term survival as landscape features, increasing the content of native broadleaved species to improve their contribution to the landscape and to wildlife interest.
- Enhancing the contrast between the open plateau and the scarp slopes of the Cliff by increasing the area of broadleaved woodland along the scarp slopes, but retaining panoramic views and giving preference to heathland restoration on sandy soils; increased woodland cover will improve the infiltration of rain, reduce soil erosion and improve water quality.
- Expanding and buffering isolated and fragmented woodlands where this is not in conflict with the priority habitats of heathland, acid and calcareous grassland.
- Protecting and managing the small areas of wet woodland, and negotiating with land managers to bring adjacent land into management in order to buffer the hydrological conditions and expand the area of woodland.
- Ensuring that green infrastructure is incorporated into new development, and that sustainable drainage systems are used as far as possible, to enable water to infiltrate and to provide access and recreational opportunities for residents.
- Creating more routes for use by walkers, cyclists and horse riders, to enable the populations of Lincoln and Scunthorpe and small towns to access and enjoy the surrounding countryside, finding links with existing accessible sites and semi-natural habitats, especially woodlands.
- Extending the Ironstone Walk around Scunthorpe and developing more links and circular routes to improve access to greenspaces.
- Negotiating opportunities to improve access to the countryside, including parklands and estates where appropriate, providing easy access routes for all.

**SEO 4: Protect and manage sites and features of historic, geological and geomorphological interest, such as sand dune formations and rock exposures, Roman roads, stone walls and vernacular architecture, and Lincoln's historic centre, to strengthen sense of place and history, enhance biodiversity and improve understanding of how the landscape has developed over time.**

**For example, by:**

- Managing disused limestone, ironstone and sand quarries in order to retain their features of geological interest, expanding the priority habitats, notably limestone grassland, dry acid grassland and heathland.
- Providing access to and interpretation of sites of geological or geomorphological interest where possible, to raise awareness and improve understanding.
- Identifying historic ground features including prehistoric burial mounds and evidence of deserted medieval villages, and encouraging their protection through cessation of cultivation and establishment of permanent grassland where possible.
- Protecting and restoring historic features within parklands and estates, including management of ancient and veteran trees, and providing opportunities for access for quiet recreation where appropriate.
- Providing access to sites of historic interest, along with interpretation, to raise awareness and improve understanding and enjoyment of local history.
- Retaining the network of long, straight roads of Roman origin.
- Maintaining and restoring walls built of limestone rubble.
- Using appropriate materials and techniques when restoring vernacular architecture, to retain the visible links between underlying geology and the integrity of the historical development of farms and villages.
- Providing interpretation of historic features where appropriate, to improve understanding and enjoyment of all the features that have contributed to the landscape of today.
- Conserving the historic character of the villages along the springline below the scarp, ensuring that any new development or conversions are accommodated without reducing the historic interest, using local building materials where possible.
- Protecting stone-built vernacular architecture including farmhouses, farm buildings and barns, houses, churches and drystone walls, using appropriate building materials and techniques when restoring or converting.
- Protecting, conserving and interpreting the cathedral, the many town houses and other structures that reveal the rich Roman and medieval history of the city of Lincoln, thus supporting tourism and education and ensuring that a sense of history is shared with residents and visitors.
- Protecting the inland sand dune systems and other wind-blown sand formations, and providing interpretation to raise awareness of these distinctive formations.
- Identifying opportunities to allow the River Ancholme and its tributaries to follow more natural courses, introducing more structural diversity into the river habitats, and allowing geomorphological processes to occur, thus also reducing the energy of flood flows and increasing flood storage capacity.

# Supporting document 1: Key facts and data

**Area of Northern Lincolnshire Edge with Coversands National Character Area (NCA): 50,057 ha**

## 1. Landscape and nature conservation designations

There are no National Parks or Area of Outstanding Natural Beauty 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) | % of NCA |
|---|---|---|---|---|
| International | Ramsar | Humber Estuary | 1 | <1 |
| European | Special Protection Area (SPA) | Humber Estuary SPA | 1 | <1 |
| | Special Area of Conservation (SAC) | Humber Estuary SAC | 1 | <1 |
| National | National Nature Reserve (NNR) | 0 | 0 | <1 |
| | Site of Special Scientific Interest (SSSI) | A total of 17 sites wholly or partly within the NCA | 469 | 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.*

There are 123 local sites in Northern Lincolnshire Edge with Coversands covering 2,570 ha, which is 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/website/magic/** – select 'Rural Designations Statutory'

#### 1.1.1 Condition of designated sites

| SSSI condition category | Area (ha) | Percentage of NCA SSSI resource |
|---|---|---|
| Unfavourable declining | 11 | 2 |
| Favourable | 132 | 29 |
| Unfavourable no change | 43 | 10 |
| Unfavourable recovering | 270 | 59 |

**Source: Natural England (March 2011)**

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

## 2. Landform, geology and soils

### 2.1 Elevation

The lowest elevation is 0.2 m below sea level and the highest point is 77 m. The mean elevation across the NCA is 29 m.

**Source: Natural England 2010**

## 2.2 Landform and process

The most distinctive topographical feature of the area is the western scarp slope locally known as the 'Cliff'. This linear feature is pronounced along much of its length.

**Source: Northern Lincolnshire Edge with Coversands/Southern Lincolnshire Edge Countryside Character Area Description**

## 2.3 Bedrock geology

The solid geology of the Northern Lincolnshire Edge with Coversands is composed almost entirely of the middle Jurassic Lincolnshire Limestone. The Frodingham Ironstone forms the secondary scarp around Scunthorpe.

**Source: Northern Lincolnshire Edge with Coversands/Southern Lincolnshire Edge Countryside Character Area Description**

## 2.4 Superficial deposits

Most of the area has been overlaid by glacial deposits of boulder clays, windblown sand and fluvio-glacial sands and gravels.

**Source: Northern Lincolnshire Edge with Coversands/Southern Lincolnshire Edge Countryside Character Area Description**

## 2.5 Designated geological sites

| Tier | Designation | Number |
|---|---|---|
| National | Geological Site of Special Scientific Interest (SSSI) | 5 |
| National | Mixed Interest SSSI | 1 |
| Local | Local Geological Sites | 25 |

**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

Soils on the higher ground are shallow, well-drained and brashy loams, devoid of surface streams. To the east and north the soils include some clay with associated poorer drainage. The Coversands which lie over much of the northern part of the Edge are predominantly windblown deposits. They produce light soils supporting a contrasting flora.

**Source: Northern Lincolnshire Edge with Coversands/Southern Lincolnshire Edge Countryside Character Area Description, Lincolnshire Coversands and Clay Vales Natural Area Profile**

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

| Grade | Area (ha) | % of NCA |
|---|---|---|
| Grade 1 | 127 | <1 |
| Grade 2 | 19,816 | 40 |
| Grade 3 | 21,604 | 43 |
| Grade 4 | 1,237 | 3 |
| Grade 5 | 0 | 0 |
| Non-agricultural | 3,875 | 8 |
| Urban | 3,398 | 7 |

**Source: Natural England (2010)**

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

## 3. Key water bodies and catchments

### 3.1 Major rivers/canals

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

- River Eau 11 km
- Old River Ancholme 2 km

**Source: Natural England (2010)**

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

The Old River Ancholme drains the northern half of the NCA into the Humber. The River Eau drains the southern half of the NCA into the River Witham, and ultimately to the Wash.

### 3.2 Water quality

The total area of Nitrate Vulnerable Zone is 50,057 ha, which is 100 per cent of NCA.

**Source: Natural England (2010)**

### 3.3 Water Framework Directive

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

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

## 4. Trees and woodlands

### 4.1 Total woodland cover

The NCA contains 3,254 ha of woodland (7 per cent of the total area), of which 275 ha is ancient woodland.

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

### 4.2 Distribution and size of woodland and trees in the landscape

The Coversands were extensively planted with conifers between the First and Second World Wars. Birch and oak are regenerating naturally to add to the mix. A few pockets of ancient semi-natural woodland can be found at Broughton.

**Source: Northern Lincolnshire Edge with Coversands/Southern Lincolnshire Edge Countryside Character Area Description**

### 4.3 Woodland types

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

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

| Woodland type | Area (ha) | % of NCA |
|---|---|---|
| Broadleaved | 1,856 | 4 |
| Coniferous | 893 | 2 |
| Mixed | 103 | <1 |
| Other | 402 | 1 |

**Source: Forestry Commission (2011)**

Area and proportion of ancient woodland and planted ancient woodland within the NCA.

| Type | Area (ha) | % of NCA |
|---|---|---|
| Ancient semi-natural woodland | 44 | <1 |
| Planted Ancient Woodland (PAWS) | 231 | <1 |

**Source: Natural England (2004)**

## 5. Boundary features and patterns

### 5.1 Boundary features

In the drier central uplands are arable areas. Where present, hedgerows are clipped and gappy. Shelter belts, typically of beech and sycamore, often line roads, tracks and broad verges.

**Source: Northern Lincolnshire Edge with Coversands/Southern Lincolnshire Edge Countryside Character Area Description; Countryside Quality Counts (2003)**

### 5.2 Field patterns

Fields are typically rectilinear with gappy, clipped hedgerows and occasional rubble limestone walls.

**Source: Northern Lincolnshire Edge with Coversands/Southern Lincolnshire Edge 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

Sixty-five per cent of the area's farms were arable (46 per cent cereals, 17 per cent general cropping, 2 per cent horticulture). Seventeen per cent of farms were made up of livestock holdings (grazing livestock 7 per cent, specialist poultry 6 per cent and specialist pigs 4 per cent).

**Source: Agricultural Census, Defra (2010)**

### 6.2 Farm size

In 2009 41 per cent of farms (108 of 261 holdings) were greater than 100 ha in size, and this category of farm accounted for 89 per cent of the agricultural area. There was a fairly equal spread of sizes among the remaining farms. The broad pattern was similar to the 2000 census, although there were significantly less farms between 5 ha and 20 ha in 2009 (down from 58 in 2000 to 40 in 2009) and farms greater than 100 ha (from 125 to 108).

**Source: Agricultural Census, Defra (2010)**

### 6.3 Farm ownership

2009: Total farm area = 38,368 ha; owned land = 27,057 ha
2000: Total farm area = 39,762 ha; owned land = 22,808 ha

**Source: Agricultural Census, Defra (2010)**

### 6.4 Land use

Half the agricultural area was under cereals. Fifteen per cent was grass and uncropped land, 16 per cent oilseeds and 6 per cent cash roots. Land with oilseeds had almost doubled between 2000 and 2009, while cash roots almost halved.

**Source: Agricultural Census, Defra (2010)**

### 6.5 Livestock numbers

Pigs accounted for the majority of livestock (37,300) followed by cattle (4,000) and sheep (3,800).

**Source: Agricultural Census, Defra (2010)**

### 6.6 Farm labour

There were 682 agricultural workers in this area in 2009 (down from 988 in 2000). Of these, 49 per cent were principal farmers, 26 per cent full-time workers, 10 per cent part-time workers, 8 per cent salaried managers and 7 per cent casual/gang workers.

**Source: Agricultural Census, Defra (2010)**

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

## 7. Key habitats and species

### 7.1 Habitat distribution/coverage

Some of Britain's finest inland sand dunes can be found on the Coversands. Nationally rare and important species include woodlark and grayling butterfly. Coversand heathlands comprise a mosaic of lowland heathland, often with a high proportion of lichens and some heather, with pockets of mire and wet heath, areas of lowland dry acid grassland and sand dune habitats. These heathlands are close in type to those of the Brecks, and several areas are designated as Sites of Special Scientific Interest. Elsewhere small pockets of calcareous grassland occur where the limestone outcrops from the Coversands or is close to the surface. There is very little ancient woodland, but oak–birch woodland has established on some parts of the Coversands. Broughton Alder Wood lies in a shallow valley which is fed by springs from adjacent pastures and forestry plantations. Open water habitats have been created from restored ironstone and sand workings.

**Source: North Lincolnshire Coversands and Clay Vales 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) | % of NCA |
|---|---|---|
| Broadleaved mixed and yew woodland (broad habitat) | 989 | 2 |
| Fens | 363 | 1 |
| Lowland dry acid grassland | 297 | 1 |
| Lowland calcareous grassland | 131 | <1 |
| Purple moor grass and rush pasture | 111 | <1 |
| Lowland heathland | 52 | <1 |
| Coastal and flood plain grazing marsh | 11 | <1 |
| Lowland meadows | 7 | <1 |

**Source: Natural England (2011)**

Maps showing locations of priority habitats are available at

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

### 7.3 Key species and assemblages of species

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

## 8. Settlement and development patterns

### 8.1 Settlement pattern

The pattern of settlement is dispersed to the perimeter but almost non-existent on the central elevated higher ground. The old city of Lincoln includes castle, city walls, churches and fine town houses. These buildings cluster around the cathedral. Scunthorpe, the other large settlement of the area, grew rapidly in the 19th century following the establishment of iron and steel works. The expanding town absorbed five villages and is now characterised by post-Second World War housing and industrial estates.

**Source: Northern Lincolnshire Edge with Coversands/Southern Lincolnshire Edge Countryside Character Area Description; Countryside Quality Counts (2003)**

### 8.2 Main settlements

The main settlements in Northern Lincolnshire Edge with Coversands NCA are Lincoln, Scunthorpe, Gainsborough, Broughton, Winterton, and Scarsby. The total estimated population for this NCA (derived from ONS 2001 census data) is 157,465.

**Source: Northern Lincolnshire Edge with Coversands/Southern Lincolnshire Edge Countryside Character Area Description; Countryside Quality Counts (2003)**

### 8.3 Local vernacular and building materials

To the foot of the western scarp a line of small villages built in traditional honey coloured limestone, warm brick and pantiles cluster by the springs. In Lincoln, to the south of the railway station, settlement is dominated by red-brick terraces dating from the city's growth as an engineering centre.

**Source: Northern Lincolnshire Edge with Coversands/Southern Lincolnshire Edge Countryside Character Area Description; Countryside Quality Counts (2003)**

## 9. Key historic sites and features

### 9.1 Origin of historic features

A clear line of visible archaeological evidence is present along the Edge. The Romans made a very visible impact on the landscape; Lincoln was the key settlement at the junction of Ermine Street and the Fosse Way. A number of deserted medieval villages like Gainsthorpe are testimony to subsequent change during the medieval period when farming developed to the perimeter of the Edge. The landscape around Scunthorpe was dramatically altered by the mining of ironstone from the 1870s. The growth of the iron and steel industry had a significant impact on the natural landscape.

**Source: Draft Historic Profile, Countryside Quality Counts, Northern Lincolnshire Edge Countryside Character Area description**

### 9.2 Designated historic assets

This NCA has the following historic designations:

- 4 Registered Parks and Gardens covering 191 ha
- 0 Registered Battlefields
- 63 Scheduled Monuments
- 812 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

- 2 per cent of the NCA (843 ha) is classified as being publically accessible.
- There are 260 km of public rights of way, giving a density of 0.5 km per km$^2$.
- There are no National Trails within the NCA.

**Source: Natural England (2010)**

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

| Access designation | Area (ha) | % of NCA |
|---|---|---|
| National Trust (Accessible all year) | 0 | 0 |
| Common Land | 5 | <1 |
| Country Parks | 73 | <1 |
| CROW Access Land (Section 4 and 16) | 255 | <1 |
| CROW Section 15 | 19 | <1 |
| Village Greens | 6 | <1 |
| Doorstep Greens | 0 | 0 |
| Forestry Commission Walkers Welcome Grants | 293 | 1 |
| Local Nature Reserves (LNRs) | 116 | <1 |
| Millennium Greens | 1 | <1 |
| Accessible National Nature Reserves (NNRs) | 0 | 0 |
| Agri-environment Scheme Access | 77 | <1 |
| Woods for People | 382 | 1 |

**Sources: Natural England (2011)**

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

## 11. Experiential qualities

### 11.1 Tranquillity

Based on the CPRE map of tranquillity (2006) the highest scores for tranquillity are to the south-east and north of the NCA in very rural areas. The lowest scores for tranquillity are around the settlements, such as Lincoln and Gainsborough.

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

| Category of tranquillity | Score |
|---|---|
| Highest value within NCA | 42 |
| Lowest value within NCA | -93 |
| Mean value within NCA | -4 |

**Source: CPRE (2006)**

- More information is available at the following address: **http://www.cpre.org.uk/campaigns/landscape/tranquillity/our-tranquillity-map-explained**

### 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, particularly around Lincoln, areas are increasingly disturbed, whereas the more rural areas and villages experience less intrusion.

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

| Category of intrusion | 1960s (%) | 1990s (%) | 2007 (%) | % change (1960s-2007) |
|---|---|---|---|---|
| Disturbed | 22 | 35 | 47 | 25 |
| Undisturbed | 73 | 60 | 44 | -29 |
| Urban | 5 | 5 | 9 | 4 |

**Sources: CPRE (2007)**

Notable trends from the 1960s to 2007 were an increase in the area of disturbed land by 25 per cent, matched by a decrease in the areas of undisturbed land by 29 per cent. The levels of urban land increased slightly by 4 per cent.

- More information is available at the following address: http://www.cpre.org.uk/campaigns/planning/intrusion/our-intrusion-map-explained

**The Coversands, wind-blown sands from post-glacial times, give rise to a distinctive landscape of heathland, dry acid grassland and oak / birch woodland. Many of these sandy soils are now taken over by arable cropping, such as the field in the middle distance to the right, and tree planting.**

## 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)
- Priority Habitats GIS data, Natural England (March 2011)
- Special Areas of Conservation data, Natural England (data accessed in March 2011)
- Special Protection Areas data, Natural England (data accessed in March 2011)
- Ramsar sites data, Natural England (data accessed in March 2011)
- Sites of Special Scientific Interest, Natural England (data accessed in March 2011)
- Detailed River Network, Environment Agency (2008)
- Source protection zones, Environment Agency (2005)
- Registered Common Land GIS data, Natural England (2004)
- Open Country GIS data, Natural England (2004)
- Public Rights of Way Density, Defra (2011)
- National Trails, Natural England (2006)
- National Tranquillity Mapping data, CPRE (2007)
- Intrusion map data, CPRE (2007)
- Registered Battlefields, English Heritage (2005)
- Record of Scheduled Monuments, English Heritage (2006)
- Registered Parks and Gardens, English Heritage (2006)
- World Heritage Sites, English Heritage (2006)
- Incorporates Historic Landscape Characterisation and work for preliminary Historic Farmstead Character Statements (English Heritage/Countryside Agency 2006)

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

# Supporting document 2: Landscape change

## Recent changes

### Trees and woodlands

- At the end of 1998, young trees approved for planting under a Woodland Grant Scheme agreement accounted for about 3 per cent of the mature woodland stock. Between 1999 and 2003 an area equivalent to 4 per cent of the 1999 total stock was approved for new planting under a Woodland Grant Scheme agreement (107 ha). In 1999 about 26 per cent of the established eligible National Inventory of Woodlands and Trees stock was covered by a Woodland Grant Scheme management agreement.

### Boundary features

- Between 1999 and 2003, Countryside Stewardship agreements for linear features included fencing (22 km), hedge management (29 km), hedge planting and restoration (45 km), restored boundary protection (10 km) – extent limited. By 2011 some 66 km of hedges and 19 km of ditches were under management through the Environmental Stewardship schemes, but only 1.5 km of stone wall was covered.

- On the open plateau the remaining hedges continue to be tightly clipped.

### Agriculture

- About 80 per cent of the land is cropped, with little change evident between 2000 and 2009. Around 90 per cent of the land is managed within holdings of over 100 ha, and again there was little change between 2000 and 2009. There are several specialist pig and poultry farms, although pig numbers have fallen from nearly 47,000 in 2000 to just over 37,000 in 2009.

- The most extensive annual agreements in 2003 were for lowland pastures on neutral/acid soils (231 ha) and overwintered stubble followed by spring/summer fallow (154 ha).

- The need for irrigation on the free-draining limestone, to maintain and extend the range of crops that can be grown, such as potatoes, has resulted in the construction of a number of embanked rectilinear reservoirs in recent years.

### Settlement and development

- Although the rate of urbanisation and development outside urban and urban fringe areas is low, development is concentrated and significant locally. Concentrations include around Alkborough in the north, the urban fringes of Scunthorpe and Lincoln, and the neighbouring villages of Welton and Dunholme.

- The development of the M180 has contributed to the expansion of light industry in Scunthorpe, and recently urban Lincoln has expanded up to the bypass to the north.

### Semi-natural habitat

- The most extensive annual Countryside Stewardship agreements in 2003 were for lowland pastures on neutral/acid soils (231 ha) and overwintered stubble followed by spring/summer fallow (154 ha). However there has been only a limited area covered by uptake of Countryside Stewardship agreements for re-creation of heathland (64 ha) and for bracken control.

- The condition of some of the heathlands on the Coversands has deteriorated through a lack of grazing. The Coversands Projects (2003–2008) addressed this by supporting new grazing initiatives, and aimed to restore 700 ha of lowland heath and to re-create a further 250 ha. There is a continuing need for bracken and scrub control in some places.

### Historic features

- In 1918 about 2 per cent of the NCA was historic parkland, but it is estimated that by 1995 some 50 per cent of the area had been lost. About 20 per cent of the remaining parkland is covered by a Historic Parkland Grant and 18 per cent is included in an agri-environmental scheme. Some 79 per cent of historic farm buildings remain unconverted, and most are intact structurally.

- There is ongoing loss of military archaeology (buildings, plan-forms, key installations) related to the airfields and bases along the Edge, either through reversion to farmland or change of use to storage or retail outlets.

### Coast and rivers

- The biological river water quality in 1995 was predominantly excellent and it has been maintained. The chemical water quality in 1995 was predominantly very good and it has also been maintained. However, by 2013 the Trent and Anglian River Basin management plans indicate that surface waters flowing down into the Ancholme were failing to reach good chemical status and have poor ecological status, although the status of the groundwaters in the east is good. To the west, the status of groundwaters is poor.

- The entire area was designated a nitrate vulnerable zone for both surface and groundwater in 2006.

### Minerals

- Ironstone mining has now ceased, and several sites have been restored for agriculture, recreational use and nature conservation. However, ironstone reserves remain and are being protected for possible future exploitation. While there are now several disused limestone quarries and sand extraction sites, sand (silica) continues to be extracted, for instance at Messingham.

## Drivers of change

### Climate change

A summary of climate change risks for the East Midlands[4] indicates that:

- There is a possibility of an increase in the number of flood events affecting the farmland alongside the Trent and the town of Gainsborough.

- Higher summer soil moisture deficits would increase the demand for water to irrigate to maintain crop yields and quality.

- Increasing demand for water resources in an area of low rainfall may limit agriculture, and/or impact on water quality and freshwater habitats.

- There may be a move towards new crops or increased yields from traditional crops, due to warmer conditions.

- There could be an increase in fire risk especially in the areas of heath and woodland on the Coversands.

[4] www.climate-em.org.uk/images/uploads/EastMidlands-NewText-2Apdf.pdf published by Climate East Midlands 2012 and accessed on 16 January 2014

- New conditions may favour generalist species, pests, diseases and invasive non-native species, leading to a reduction in biodiversity and/or disrupting habitats.
- Phenological mismatch may lead to a disruption of food species thus putting species and ecosystem services at risk; for instance, a decline in invertebrates as a result of drier moorland habitats could become out of step with breeding birds.
- In addition, it is anticipated that more frequent and more intense storm events may increase the amount of surface water run-off from agricultural land, thus increasing diffuse pollution from sediment and nutrient run-off.
- An increase in droughts, especially in the summer, could affect productivity of the farmed land, and increase demand for water for irrigation, especially on the free-draining soils on the plateau. Reduced groundwater flows combined with an increased demand for water could have significant impacts on the aquifer.
- Pests and diseases new to the area may occur as a result of increased temperatures.

## Other key drivers

- Continuing pressure for water for domestic, industrial and agricultural use may lead to the lowering of water tables and impacts on watercourses downstream.
- Large urban extensions can be expected on the edges of Gainsborough and Lincoln, both identified as areas of potential growth.
- Some villages such as Welton and Nettleham are likely to experience some piecemeal growth.
- These areas of significant expansion could impact on the local landscape, placing more demands on the water available in the aquifer, but also opening up opportunities to improve green infrastructure and to provide links to the adjacent countryside for both access and biodiversity.
- Proposals for substantial housing and industrial developments on the outskirts of Scunthorpe could increase traffic levels and the demand for potable water, as well as for access to the countryside.
- Agricultural developments such as new crops, along with an increased demand for water for crop irrigation, may lead to the construction of further reservoirs.
- Economic conditions may alter to make the extraction of ironstone an attractive prospect again.
- Restoration of ironstone workings continues, creating opportunities to provide semi-natural habitats, along with access and recreational uses, in particular related to open water.
- Further new uses may be found for disused airfields.
- Continuing demand for renewable energy may lead to further proposals for wind farms on the plateau, away from active airfields, and biomass crops.
- Continuing encroachment of heathlands by weeds (bracken) and scrub, along with changes in grazing pressures, may result in deterioration of condition of lowland heathland and dry acid grassland.

# 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.

**Scunthorpe continues to expand, with large retail and manufacturing parks on its outskirts. Here, to the north of Scunthorpe, is evidence of past ironstone workings, below the wooded limestone scarp. Now restored, the land is used for agriculture, industry and windfarms.**

| Statement of Environmental Opportunity | Food provision | Timber provision | Water availability | Genetic diversity | Biomass provision | Climate regulation | Regulating water quality | Regulating water flow | Regulating soil quality | Regulating soil erosion | Pollination | Pest regulation | Regulating coastal erosion | Sense of place/inspiration | Sense of history | Tranquility | Recreation | Biodiversity | Geodiversity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ecosystem Service | | | | | | | | | | | | | | | | | | |
| SEO 1: On the limestone plateau, manage the high-quality farmland and maintain agricultural productivity, establishing networks of linking habitats to strengthen landscape character and enhance biodiversity, especially farmland birds, while also protecting the underlying aquifer, reducing soil erosion and improving soil and water quality. | ↑ *** | ↔ ** | ↑ *** | n/a | ↗ ** | ↑ ** | ↑ *** | ↗ ** | ↑ *** | ↑ *** | ↗ *** | ↑ ** | ↗ ** | ↗ *** | ↗ *** | ↔ * | ↔ ** | ↑ *** | ↔ ** |
| SEO 2: On the sandy soils of the Coversands, protect the distinctive dune formations and expand, buffer and connect the key habitats, providing access and interpretation where possible, and addressing climate regulation, soil erosion and water availability. | ↔ ** | ↗ *** | ↗ *** | n/a | ↗ ** | ↑ *** | ↑ *** | ↗ ** | ↑ * | ↗ ** | ↗ ** | ↗ ** | n/a | ↑ *** | ↗ *** | ↑ *** | ↗ ** | ↑ *** | ↑ *** |

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

Dark plum = National Importance; Mid plum = Regional Importance; Light plum = Local Importance

| Statement of Environmental Opportunity | Ecosystem Service | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Food provision | Timber provision | Water availability | Genetic diversity | Biomass provision | Climate regulation | Regulating water quality | Regulating water flow | Regulating soil quality | Regulating soil erosion | Pollination | Pest regulation | Regulating coastal erosion | Sense of place/inspiration | Sense of history | Tranquility | Recreation | Biodiversity | Geodiversity |
| SEO 3: Maintain the sense of place and the diversity of settlements and landscape features through expanding semi-natural habitats, managing the restoration of extraction sites, retaining the inspirational long views, ensuring that development is sustainable and well integrated into the landscape, and providing more interpretation and access through good green infrastructure links. | ↗ ** | ↑ *** | ↗ ** | n/a | ↑ ** | ↗ *** | ↗ *** | ↔ ** | ↗ ** | ↗ ** | ↑ *** | ↗ ** | ↗ * | ↑ *** | ↗ ** | ↗ ** | ↗ *** | ↑ *** | ↔ *** |
| SEO 4: Protect and manage sites and features of historic, geological and geomorphological interest, such as sand dune formations and rock exposures, Roman roads, stone walls and vernacular architecture, and Lincoln's historic centre, to strengthen sense of place and history, enhance biodiversity and improve understanding of how the landscape has developed over time. | ↔ *** | ↔ *** | ↔ ** | n/a | ↔ *** | ↗ ** | ↔ ** | ↗ * | ↔ ** | ↗ ** | ↑ * | ↔ ** | n/a | ↑ *** | ↑ *** | ↗ ** | ↑ *** | ↗ *** | ↑ *** |

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

Dark plum = National Importance; Mid plum = Regional Importance; Light plum = Local Importance

## Landscape attributes

| Landscape attribute | Justification for selection |
|---|---|
| Underlying geology of Jurassic Limestone forming a distinctive north–south ridge with scarp slope on west side; ironstone to north of Scunthorpe. | ■ Distinct landform of cliff and open plateau contributes to a strong sense of place.<br>■ Five Sites of Special Scientific Interest designated for their geological interest, along with 25 Local Geological Sites.<br>■ Ironstone contains many fossils, including oysters and ammonites, while disused limestone quarries reveal underlying limestone formations and calcareous habitats.<br>■ Presence of ironstone has determined historical development of iron and steel manufacturing and associated engineering works that dominate Scunthorpe and surrounds.<br>■ Disused limestone, ironstone and sand quarries now provide important exposures of geological features along with semi-natural habitats. |
| Windblown sands north and east of Scunthorpe giving rise to inland dune system and supporting dune and dry heath vegetation, with some conifer plantations and oak/birch woodland. | ■ Sandy soils give rise to a distinctive acidic landscape of open heathland with birch and oak woodlands.<br>■ Risby Warren SSSI comprises one of the finest inland dune systems in Britain, with clear surface morphology and sand dune forms, along with heathland, acid and calcareous grassland and scrub.<br>■ Sand exploited for building and engineering uses, and latterly silica sand exploited for industrial processes, giving rise to sites with a range of habitats from open water to acid grassland, dry heath and scrub, with opportunities for access and recreation. |
| Free draining loamy soils on limestone ridge giving rise to productive cropping managed from large farmsteads and organised within large rectilinear fields, bounded by tightly cropped hedgerows and occasional limestone rubble walls. | ■ Productive farmland, most of it managed in large units over 100 ha.<br>■ Predominantly arable (cereals, oilseeds, potatoes and other arable crops) with specialist pig and poultry farms.<br>■ Large rectilinear fields arising from 18th- and 19th-century enclosure of the limestone plateau.<br>■ Limestone walls more frequent on the west side of the ridge, around Fillingham and Willoughton.<br>■ Farms often large, with big sheds overshadowing the original stone-built farmhouse. |

| Landscape attribute | Justification for selection |
|---|---|
| Few trees on higher land, with occasional sheltering copses and small plantation woodlands. | ■ 6.5 per cent of the area is covered by broadleaved and mixed woodland, of which 2.5 per cent is priority broadleaved woodland habitat.<br>■ Only 44 ha of ancient semi-natural woodland, and 231 ha of plantation on ancient woodland sites.<br>■ Conifer plantations from the inter-war period remain in places on the infertile sandy soils. |
| Few settlements on higher land, but several spring-line villages along foot of scarp, with more woodlands and parklands. | ■ Distinct line of villages along springline at foot of slope – Kirton in Lindsey, Blyborough, Willoughton, Hemswell, Harpswell, Glentworth, Fillingham, Grayingham, Ingham, Brattleby, Scampton, North and South Carlton, Burton.<br>■ Parklands, for example around Blyborough and Fillingham.<br>■ Many of the villages are attractive, with houses, farmsteads and walls built of soft, warm-coloured local limestone with red or brown tiles. |
| Active and re-used airfields are prominent features on the limestone ridge along with communications masts. | ■ RAF Scampton is still active and is the base for the Red Arrows.<br>■ The airfield at Hemswell Cliff is now an industrial park with major grain store silos, warehousing and retail stores.<br>■ Disused airfields still evident through hard standing, boundaries, derelict or re-used military buildings, although some loss of military features has occurred. |
| Long straight roads, often with wide verges. | ■ Historic Roman road network evident, with minor straight roads leading off Ermine Street, now the busy A15, to cross the limestone plateau, leading to villages such as Normanby and Thealby.<br>■ Wide verges support a range of flowering species, creating important corridors for wildlife as well as providing an experience for travellers. |

| Landscape attribute | Justification for selection |
|---|---|
| Evidence of Roman influence through roads, tracks, and medieval settlement, also evidence of abandoned villages. | ■ Early settlement is visible along the Edge including prehistoric burial mounds, linear boundary features and tracks.<br>■ Ermine Street runs north–south through the area, linking the fort and colonia at Lincoln with the crossing of the River Humber.<br>■ Medieval settlement evident through current settlement names and patterns.<br>■ Ground features provide evidence for medieval villages probably abandoned as a result of agricultural changes, for instance at Gainsthorpe and Sawcliffe. |
| Panoramic views out over Humberhead Levels to the west; Lincoln Cathedral in prominent location on top of Edge above Witham Gap, and visually prominent steelworks at Scunthorpe. | ■ Views out over the Levels enjoyed in particular from viewpoints at Scampton and Hemswell.<br>■ Lincoln Cathedral visible from many miles around.<br>■ Steelworks tower above the centre of Scunthorpe and are visible from considerable distances around the town. |
| The city of Lincoln in the south, based on a Roman settlement, with medieval features still evident. | ■ Visible remains of Roman city, city walls, medieval town houses and later archaeology and architecture still evident within the city.<br>■ The Norman cathedral in Lincoln was started in 1088 and continued in phases throughout the medieval period, including two fine rose windows.<br>■ John Ruskin considered the cathedral to be "... the most precious piece of architecture in the British Isles, ... worth any two other cathedrals we have". |

## Landscape opportunities

- Protect the scarp slope from inappropriate development, increasing woodland cover where possible.
- Retain long, panoramic views out over adjacent lower-lying land, especially from the scarp slope in the west.
- Protect the inland sand dune systems and other windblown sand formations.
- Protect and manage the sandy habitats of lichen heathland, lowland heathland and dry acid grassland.
- Extend the areas of lowland heathland, linking existing areas where possible and negotiating to remove scrub and woodland where heathland restoration is possible.
- Manage existing oak and birch woodland.
- Manage existing wet woodland, and extend and buffer where possible.
- Encourage mixed farming where appropriate to introduce more managed grassland into rotations and provide conditions suitable for more farmland birds and arable plants.
- Manage existing hedges, allowing them to fill out, and plant to fill in gaps.
- Restore and introduce hedges into key locations to reinforce field patterns.
- Manage existing plantation woodlands to ensure their long-term survival as landscape features, increasing the content of native broadleaves where possible.
- Increase the area of native broadleaved woodland especially along the scarp slope of the Edge in the west, but giving preference to heathland and heathland restoration on sandy soils.
- Manage grassy verges to encourage greater species richness and to maintain them as a feature of the long straight roads.
- Manage disused limestone, ironstone and sand quarries to retain their geological interest, and expand their habitats of interest, including limestone grassland, dry acid grassland and heathland as well as open water and wetland habitats, providing access where possible.
- Restore disused ironstone and sand extraction sites, ensuring the creation of habitats such as species rich grassland, heathland and broadleaved woodland and managing them to enhance biodiversity interest as well as strengthen local landscape character; provide access and recreation where appropriate.
- In restoration schemes, ensure that new open water and wetland habitats are managed to contribute to the local landscape and enhance biodiversity interest
- Protect stone-built vernacular architecture including farmhouses and farmsteads, and use appropriate materials and techniques when restoring vernacular architecture.
- Protect and manage the historic features of parklands, including veteran trees.
- Protect long-distance views of the impressive Lincoln Cathedral.
- Protect, conserve and interpret the many town houses and other structures that reveal the rich Roman and medieval history of the city of Lincoln.
- Enhance the contrast between the open plateau and the wooded scarp slopes by encouraging more woodland establishment on the slopes.
- Encourage the establishment of permanent grassland to protect the evidence of medieval settlements and other ground features.
- Maintain and restore limestone rubble walls.
- Ensure that new irrigation reservoirs are constructed so that they contribute to biodiversity interest and fit in to local landform and landscape.

## 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** | Good quality well-drained and workable soils<br><br>Infrastructure of large farmsteads<br><br>Mostly arable holdings, with limited mixed farming, specialist poultry and pigs | The plateau provides very good conditions for arable cropping, with light, well drained brashy loams. 40 per cent of the area is categorised as Grade 2 agricultural land, and much of the remainder (43 per cent) is Grade 3. While the Coversands give rise to infertile sandy soils, in places poor drainage also reduces the quality of the soils for agriculture.<br><br>There is more mixed farming on the lower land at the foot of the Edge, with some permanent pastures and managed leys. Farms are generally large (over 100 ha).<br><br>The relatively low rainfall combined with porous bedrock means that there are few surface streams on the plateau. | National | This is a productive area for farming, including cereals, oilseeds, root crops, pigs and poultry, contributing to the employment economy. With generally large scale farming, the potential for increasing productivity may be limited, taking into consideration the need to safeguard water quality, water supplies and biodiversity, to avoid soil erosion, and to mediate climate change.<br><br>Water supplies for crop irrigation, especially potatoes, may become more of a limiting factor with climate change. In recent years a number of large reservoirs have been constructed to provide farms with a supply of water for irrigation.<br><br>Soil erosion can be exacerbated by continuous cultivation, especially when that includes periods when the soil is left bare.<br><br>Climate change may result in an increase in summer temperatures and longer growing seasons, thus making it possible to introduce new crops and/or to crop twice in a season. It may also be appropriate to introduce crops that are more drought resistant. | Work with the farming community to identify possibilities for improved productivity while ensuring soils are protected from erosion and demands for water are not increased.<br><br>Introduce crops that are more drought resistant.<br><br>Encourage cultivation practices that increase the organic content of soils and reduce sediment run-off, thus improving infiltration, reducing soil erosion and preventing sedimentation of watercourses, while also maintaining levels of production. | **Food provision**<br><br>**Water availability**<br><br>**Regulating water quality**<br><br>**Regulating soil erosion**<br><br>**Climate regulation**<br><br>**Sense of place/ inspiration** |

| Service | Assets/ attributes: main contributors to service | State | Main beneficiary | Analysis | Opportunities | Principal services offered by opportunities |
|---|---|---|---|---|---|---|
| **Timber provision** | Woodlands and plantations | Woodland cover is relatively low, at 6.5 per cent. Of this less than 2 per cent is conifer or mixed woodland. There are a limited number of plantations managed for timber production, mostly around Scunthorpe. | Local | With fairly low woodland cover here, the timber industry is limited, but the existing woodlands play an important part in strengthening the landscape, providing for biodiversity and carbon capture, and reducing wind erosion of soils.<br><br>There may be opportunities to increase the proportion of broadleaved species within conifer plantations, to improve their contribution both to the landscape and biodiversity.<br><br>In some locations, notably on the Coversands where conifer plantations are adjacent to lowland heathland and acid grassland, it would be more appropriate to restore to open habitats wherever possible, with compensation planting sites found elsewhere. | Ensure that existing woodlands are brought under management where possible to increase the production of timber, where appropriate.<br><br>Seek opportunities to remove conifer plantations from those areas where heathland or dry acid grassland could be restored, and find suitable compensation planting sites elsewhere. | **Timber provision**<br><br>**Biomass energy**<br><br>**Climate regulation**<br><br>**Biodiversity** |

| Service | Assets/attributes: main contributors to service | State | Main beneficiary | Analysis | Opportunities | Principal services offered by opportunities |
|---|---|---|---|---|---|---|
| **Water availability** | Aquifer<br><br>Rivers<br><br>Farm reservoirs | The Limestone Edge forms a watershed between the major river basins of the Trent to the west and Anglian rivers to the east.<br><br>The Lincolnshire Limestone aquifer is regionally important and large demands are placed upon it to meet domestic, industry and agricultural water supplies, as well as supporting base flows to rivers and supporting local surface water features.<br><br>The Lincolnshire Limestone can be up to 40 m thick, and groundwater movement within the aquifer is generally west to east. In the west of the area the limestone outcrops at the ground surface allowing rainfall to recharge the aquifer. The limestone becomes confined as it is overlain by younger deposits to the east. Although abstraction takes place mainly from the confined region, the aquifer becomes too deep and the quality is considered to be too poor to exploit more than a few kilometres east of the outcrop area.<br><br>**Continued on next page...** | Regional | The current approach is to only issue new licences to abstract water from the River Ancholme or those tributaries supported by the water transfer scheme that include conditions to prevent abstraction at any time when the flow in the River Ancholme is insufficient to meet the needs of the river and prior abstraction rights.<br><br>Climate change may bring drier summers, which would exacerbate the low summer flows of the rivers in this area. This would impact on water quality and freshwater habitats, as well as reducing the availability of water. One of the objectives for fresh water habitat nature conservation set out in the Natural Area Profile is to 'avoid damage to wetland and riverine habitats by over-abstraction of water'.<br><br>Farmers are already addressing this by constructing large rectilinear reservoirs for irrigation supplies. | Work with land managers to incorporate measures into cultivation to improve the structural condition of the soils and thus increase the infiltration of rainfall, for example by increasing the area of permanent grassland, and introducing green manures and fallow periods, to increase the organic content of soils.<br><br>Time cultivation activities to avoid compaction of the more clayey soils.<br><br>Ensure that the construction of reservoirs on farms to supply water for irrigation are designed to enhance biodiversity and to make a positive contribution to the landscape, by for example providing shallow sloping edges so that vegetation can establish.<br><br>Ensure that developments do not proceed unless water resources are available, to avoid putting further demands on already limited water supplies. | **Water availability**<br><br>**Food provision**<br><br>**Regulating water quality**<br><br>**Regulating soil quality**<br><br>**Regulating soil erosion**<br><br>**Sense of place/ inspiration**<br><br>**Biodiversity** |

| Service | Assets/attributes: main contributors to service | State | Main beneficiary | Analysis | Opportunities | Principal services offered by opportunities |
|---|---|---|---|---|---|---|
| **Water availability cont.** | | **... continued from previous page**<br><br>Resources are currently fully committed to existing users, so there is no further water available. However water is still available in Winterton Beck, in the north[5].<br><br>The River Basin Management Plan states that groundwater quantity is 'good' but south of Scunthorpe it has high vulnerability.<br><br>The resource availability status of the River Eau has not been assessed due to the tidal nature of the river[6].<br><br>The Ancholme water bodies are supported by water from the Trent Witham Ancholme Surface Water Transfer Scheme. This scheme comprises two river transfers, from the River Trent to the River Witham, and from the River Witham into the Toft Newton reservoir from which it flows into the River Ancholme. The TWA transfer scheme is very significant in helping to meet the needs of a number of large abstractions. | | Farmers are already addressing this by constructing large rectilinear reservoirs for irrigation supplies.<br><br>There is also potential for managing soils to ensure good structural condition, which improves infiltration rates; this can be achieved through, for instance, expanding the area of permanent grass, increasing the organic content of soils, and avoiding compaction. | Ensure that all new developments include appropriate sustainable drainage systems, in particular introducing porous surfaces where possible, to maintain infiltration of rainwater into the aquifer. | |

[5] *The Grimsby, Ancholme and Louth Catchment Abstraction Management Strategy*, Environment Agency (2013; URL: www.environment-agency.gov.uk/business/topics/water/119931.aspx; accessed on 9 January 2014)

[6] *The Lower Trent and Erewash Catchment Abstraction Management Strategy*, Environment Agency (March 2008)

| Service | Assets/ attributes: main contributors to service | State | Main beneficiary | Analysis | Opportunities | Principal services offered by opportunities |
|---|---|---|---|---|---|---|
| **Genetic diversity** | n/a | n/a | n/a | n/a | n/a | n/a |
| **Biomass energy** | Existing woodlands | The NCA has a generally medium potential yield for short rotation coppice although there are areas of high potential yield to the east of Scunthorpe and to the north of Lincoln. There is also an area of low potential to the north-east of Scunthorpe.<br><br>The potential miscanthus yield is generally high in the north of the NCA around Broughton and in the west of the NCA around Gainsborough, but medium to low elsewhere. For information on the potential landscape impacts of biomass plantings within the NCA, refer to the tables on the Natural England website[7]. | Local | The existing woodland cover of 6.5 per cent of the NCA includes some coniferous plantations for commercial production on the Coversands. This offers some potential for the provision of biomass, both through bringing unmanaged woodland under management and as a by-product of commercial timber production. Planting of biomass crops on land that could potentially be restored to heathland must be avoided.<br><br>Elsewhere miscanthus and short rotation coppice could be accommodated within the cropped landscape of the plateau, or on the lower-lying land to either side of the Edge. These crops would not be suitable on the steep slopes of the Edge itself, nor on sites that contain archaeological ground features. Periods of bare soil during the cultivation of the crops would need to be kept to the minimum to avoid soil erosion. | Encourage the management of existing woodlands to provide wood fuel for local use.<br><br>Consider planting biomass crops such as miscanthus and short rotation coppice within arable farmland, but reducing the risk of soil erosion by avoiding sloping land, and avoiding archaeological ground features. | **Biomass energy**<br><br>**Timber provision** |

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

| Service | Assets/ attributes: main contributors to service | State | Main beneficiary | Analysis | Opportunities | Principal services offered by opportunities |
|---|---|---|---|---|---|---|
| **Climate regulation** | Soils with high carbon content<br><br>Woodlands<br><br>Wetlands | The mineral soils over most of the NCA have a low carbon content (0–5 per cent) although there are a few scattered pockets in the north and the west of the NCA with a high carbon content (5–50 per cent) likely to be associated with the organic soils of drained wetlands.<br><br>These also include areas of freely draining very acid and loamy soils, naturally wet very acid sandy and loamy soils and loamy and clayey soils of coastal flats with naturally high groundwater which all have peaty or organic rich topsoils which are a store of carbon and should be conserved reflecting their important role in carbon sequestration.<br><br>Woodlands will also offer a carbon store both in their organic soils and in the growing plant material. However, woodland cover here is relatively low (6.5 per cent) and fragmented.<br><br>Wetland habitats are limited to a few wet woodlands and small areas of grazing marsh. | Local | The carbon content of the soils could be improved by reducing the frequency and area of cultivation, and through introducing green manure crops and fallow into rotations, and direct drilling.<br><br>The establishment of permanent, uncultivated strips alongside watercourses and expansion of wetland would improve carbon capture while also capturing sediment and nutrient run-off. These strips and other semi-natural habitats would both capture carbon and result in a reduction in the area subject to applications of artificial fertilisers.<br><br>Arable reversion to permanent grassland on sites with evident ground features of archaeological interest would also contribute.<br><br>While nitrogen fertilisers drive high yields, their production and the soil processes of nitrification and denitrification are significant sources of nitrous oxide, a potent greenhouse gas[8]. Applications of artificial fertilisers should match nutrient needs as far as possible.<br><br>**Continued on next page...** | Encourage the introduction of green manure crops, and of fallow within rotations.<br><br>Establish uncultivated strips of grassland or scrub and woodland alongside watercourses.<br><br>Match applications of fertilisers to nutrient needs as far as possible.<br><br>Seek opportunities to revert arable land to permanent grassland to protect archaeological ground features.<br><br>Bring woodlands into active management, encouraging natural regeneration where possible.<br><br>Protect and extend areas of wet woodland, wet pasture and grazing marsh. | **Climate regulation**<br><br>**Regulating soil erosion**<br><br>**Regulating water quality**<br><br>**Biomass energy**<br><br>**Timber provision**<br><br>**Sense of history** |

[8] *UK Plant Science: Current status and future challenges*, UK Plant Science Foundation/Society of Biology (URL: https://s3-eu-west-1.amazonaws.com/sbwebsite/pdf/UK_Plant_Science-Current_status_and_future_challenges.pdf; accessed February 2014)

| Service | Assets/ attributes: main contributors to service | State | Main beneficiary | Analysis | Opportunities | Principal services offered by opportunities |
|---|---|---|---|---|---|---|
| **Climate regulation cont.** | | | | **... continued from previous page**<br><br>Woodlands could be brought into sound management so that growth rates are optimised, and natural regeneration encouraged where possible.<br><br>Existing areas of wet woodland and grazing marsh will need to be protected. Extending and buffering these areas will both protect their hydrology and biodiversity, as well as increasing their role in carbon capture. An increase in the area of woodland would also contribute to carbon capture. | Seek opportunities to establish new woodlands, especially on the scarp slopes. | |
| **Regulating water quality** | Rivers<br><br>Aquifer<br><br>Semi-natural habitats | The whole area falls within a nitrate vulnerable zone (NVZ) for surface water, and for groundwater too where the underlying rock is limestone.<br><br>There are some dry valleys but few surface streams or rivers on the limestone plateau. However, a principal aquifer underlies the limestone, with high vulnerability for groundwater and groundwater protection zones along several small rivers on the dipslope[9].<br><br>**Continued on next page...** | Regional | All farms within the NVZ are required to comply with regulations around the application of organic and manufactured manures, including rates of application and provision of adequate storage of livestock manures. These regulations are to ensure that water quality is not affected by the application of nutrients.<br><br>As this NCA forms the watershed between major catchments, it is a potential source of diffuse pollution, rather than a recipient. | Establish strips of permanent grassland, scrub or woodland alongside all watercourses, to reduce the amount of sediments, nutrients and other chemicals entering them.<br><br>Manage the applications of manure and artificial fertilisers to maximise uptake and reduce run-off, and match inputs to needs as far as possible. | **Regulating water quality**<br><br>**Food provision**<br><br>**Climate regulation**<br><br>**Regulating soil erosion**<br><br>**Biodiversity** |

[9] http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&y=355134.0&scale=1&layerGroups=default&ep=map&textonly=off&lang=_e&topic=groundwater

| Service | Assets/ attributes: main contributors to service | State | Main beneficiary | Analysis | Opportunities | Principal services offered by opportunities |
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| **Regulating water quality cont.** | | **... continued from previous page**<br><br>Modified watercourses running down the east slope to join the Ancholme have 'moderate' ecological quality, while their chemical status is 'good'.<br><br>The surface water chemical status of the River Ancholme and the Old River Ancholme is 'failing to achieve good status' while their potential ecological status is 'poor' as is that of the River Eau in its upper section, although downstream where the river forks the ecological status is good.<br><br>The groundwater chemical status in the east of the NCA is good, but in the west of the NCA the groundwater chemical status is poor[10]. | | Measures to address water quality include matching nutrient inputs to the needs of the crops; establishing strips of unfertilised permanent grassland alongside watercourses to help to trap sediments, nutrients and chemicals before they can enter the water system; careful planning of times to spread organic and artificial fertilisers to ensure optimum take-up by crops.<br><br>Summer droughts and more frequent and more intense rainfall events may arise from climate change. These are likely to have adverse impacts on the quality of watercourses, for instance by reducing the oxygen content of the water, or by increasing the amount of sediment entering streams and rivers.<br><br>A move towards more mixed farming, resulting in an increase in the area of grassland, could have beneficial effects, although compliance with storing and spreading livestock manure would be necessary. The introduction of more grazing stock could be linked to the conservation grazing needed to manage the areas of heathland and acid grassland on the Coversands, and calcareous grassland on the limestone. | Introduce cultivation practices that reduce the extent of bare soil at any time, such as direct drilling, to reduce soil erosion.<br><br>Encourage mixed farming, to increase the carbon content of soils, but managing the storage and application of manure. | |

[10] *Water for Life and Livelihoods: River Basin Management Plan – Anglian River Basin District*, Environment Agency (2009; URL: http://a0768b4a8a31e106d8b0-50dc802554eb38a24458b98ff72d55ob.r19.cf3.rackcdn.com/geana910bspn-e-e.pdf; accessed January 2014)

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| **Regulating water flow** | Rivers<br><br>Semi-natural habitats | The two main catchments in the NCA are the Grimsby and Ancholme catchment and the River Trent Catchment. The Grimsby and Ancholme Catchment Flood Management Plan states that river flooding along the river Ancholme tributaries in this area is infrequent and the consequences of flooding are low.<br><br>However rapid run-off during severe storms can cause flooding issues in some villages, for example, both Redbourne and Waddingham are at some risk of flooding, the latter experiencing river and surface and groundwater flooding in 2007[11]. In the longer term a flood risk study is to be carried out to investigate alternative flood risk management actions to improve the situation in these villages[12].<br><br>**Continued on next page...** | Local | In the future the risk of flooding along the river Ancholme may increase as storms are expected to become more frequent and intense, but flood risk generally remains low.<br><br>Current Environment Agency policy is to reduce existing flood risk management actions, such as bank and channel maintenance, where they are out of proportion with the level of flood risk.<br><br>Reducing bank and channel maintenance could also allow for re-naturalising the course of the river and its tributaries thus improving the flow between the river and its flood plain (most of which is to the east of this NCA). This could open up opportunities to increase the extent of wetlands, and improve the condition of existing wetlands and aquatic habitats which could offer a more sustainable flood management system. | Encourage measures to improve the infiltration of rainwater, which will assist in reducing rapid run-off, such as increasing the area of grassland, woodland and other semi-natural habitats, especially within the catchments of the minor watercourses flowing east in to the Ancholme.<br><br>Seek opportunities to allow the tributaries of the river Ancholme to follow more natural courses and spill out into flood storage areas in the flood plain at times of flood flows.<br><br>Establish buffer strips alongside watercourses, of scrub, woodland or grassland, to slow the rate of run-off. | **Regulating water flow**<br><br>**Regulating water quality**<br><br>**Climate regulation**<br><br>**Sense of place/ inspiration**<br><br>**Biodiversity** |

[11] *Grimsby and Ancholme Catchment Flood Management Plan,* Environment Agency (2009; URL: www.environment-agency.gov.uk/research/planning/114303.aspx)
[12] Ibid.

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| **Regulating water flow cont.** | | **... continued from previous page**<br><br>The Trent Catchment Flood Management Plan identifies a high risk of flooding, exacerbated by rising sea levels, along the Trent itself[13], but this lies to the west of this NCA.<br><br>Within the NCA, Gainsborough is at risk of flooding from the River Trent. It already has hard flood defences (embankments) in place along the River Trent providing protection on both banks of the river[14]. | | Sea level rise may also result in increased tide locking at South Ferriby outfall, on the Humber Estuary to the east of this NCA. When the tide is high water is prevented from flowing out to the sea thus increasing the periods of high water levels in the River Ancholme. In the short term, the aim is to maintain existing flood protection here.<br><br>Sea level rises, along with more intense rainfall events, are likely to lead to more frequent overtopping of tidal River Trent defenses, potentially causing them to fail. Accordingly an appropriate flood alleviation scheme is to be drawn up for Gainsborough[15].<br><br>Measures that improve the infiltration rates of rainfall and slow down the flow of surface water will assist with reducing rapid run-off, as well as ensuring that water feeds in to the aquifer. | | |

[13] *Trent Catchment Flood Management Plan,* Environment Agency (URL: www.environment-agency.gov.uk/research/planning/33586.aspx ; accessed 9 January 2014)
[14] Ibid.
[15] *The River Trent Catchment Flood Management Plan*. Environment Agency (December 2010)

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| **Regulating soil quality** | Good quality soils – 40 per cent Grade 2, 43 per cent Grade 3<br><br>Coversands | There are nine main soilscapes in this NCA:<br><br>■ Shallow lime-rich soils over limestone (24 per cent).<br>■ Freely draining lime-rich loamy soils (23 per cent).<br>■ Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (16 per cent).<br>■ Freely draining slightly acid sandy soils (10 per cent).<br>■ Freely draining slightly acid but base-rich soils (9 per cent).<br>■ Freely draining very acid sandy and loamy soils (6 per cent).<br>■ Naturally wet very acid sandy and loamy soils (5 per cent).<br>■ Loamy and clayey soils of coastal flats with naturally high groundwater (3 per cent).<br>■ Loamy soils with naturally high groundwater (2 per cent). | Regional | The shallow lime-rich soils over limestone and the freely draining lime-rich loamy soils are typically of shallow to moderate depth and droughty but due to their calcareous nature have a degree of natural resilience which can be enhanced by management interventions that increase organic matter content.<br><br>The freely draining slightly acid sandy soils may also have potential for increasing organic matter levels by management interventions which will also help to minimise erosion risk.<br><br>These soils are all valuable for aquifer recharge requiring the maintenance of good structural conditions to aid water infiltration and requiring the matching of nutrients to needs to prevent pollution of the underlying aquifer.<br><br>While the sandy soils have potential for improvement through measures to increase their organic matter levels, which would also minimise erosion risk, this does not apply to those infertile Coversands supporting the semi-natural habitats of heathland, dry acid grassland, scrub and oak/birch woodland.<br><br>**Continued on next page...** | On the shallow soils of the plateau, introduce fallow and/or green manure into rotations.<br><br>Work with land managers to modify cultivation practices to increase the organic content of soils, for instance retaining stubbles over-winter, carrying out direct drilling, ploughing in green manures and stubbles, measures which will have long term benefits for productivity.<br><br>Manage the timing of cultivations on those soils vulnerable to compaction or capping, to avoid damaging them when wet. | **Regulating soil quality**<br><br>**Food provision**<br><br>**Water availability**<br><br>**Climate regulation**<br><br>**Regulating water quality**<br><br>**Regulating soil erosion** |

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| **Regulating soil quality cont.** | | | | **... continued from previous page**<br><br>The slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils may suffer compaction and/or capping as they are easily damaged when wet. In turn this may lead to increasingly poor water infiltration and diffuse pollution as a result of surface water run-off. However, management measures that increase organic matter levels can help reduce these problems. | | |
| **Regulating soil erosion** | Shallow lime-rich soils<br><br>Acid sandy soils<br><br>Semi-natural habitats, hedgerows | The majority of the soils within this NCA (covering some 77 per cent) are prone to soil erosion. These include the dominant shallow lime-rich soils that are particularly prone to erosion on sloping cultivated ground or where soil is bare, for example along tracks or as a result of outdoor pig rearing.<br><br>Equally the free draining sandy soils are highly prone to erosion where the soil is bare, compacted or where organic matter levels are low after continuous arable cultivation, especially on steep slopes where there will be rapid runoff during storm events.<br><br>**Continued on next page...** | Regional | Soil erosion is a particular issue here, and is likely to be exacerbated by climate change which will bring more frequent and more intense rainfall and storm events, and also potentially longer periods of drought.<br><br>The sandy soils of the Coversands are particularly vulnerable to wind erosion, although some bare sand and open swards are desirable within the heathlands to enhance biodiversity interest.<br><br>Erosion can be reduced by introducing a range of measures into cultivation practices to avoid exposure of bare soils, and to increase organic content. | Work with land managers and use agricultural stewardship schemes to modify cultivation practices through, for example, avoiding cultivation on slopes; introducing grass strips across slopes to capture sediment; increasing the area of permanent grassland and grass leys, especially on sloping ground; introducing fallow into crop rotations; keeping the period when soils are bare to a minimum; retaining stubble over-winter; and increasing the organic content of soils by using green manure crops in rotations. | **Regulating soil erosion**<br><br>**Climate regulation**<br><br>**Regulating water quality**<br><br>**Regulating soil quality**<br><br>**Regulating water flow** |

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| **Regulating soil erosion cont.** | | **... continued from previous page**<br><br>There is also widespread potential for wind erosion where sandy soils are cultivated or left bare, especially in spring.<br><br>The freely draining slightly acid but base-rich soils may be susceptible to capping and slaking, increasing the risk of soil erosion and requiring the careful timing of cultivations and maintenance of vegetation cover. The naturally wet very acid sandy and loamy soils are also easily eroded if heavily trafficked or after heavy rain and when dry can be subject to wind erosion.<br><br>The slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils and the loamy and clayey soils with naturally high groundwater (together covering 19 per cent of the NCA) are generally at low risk of soil erosion. | | Where soils are prone to wind erosion, then the restoration of hedgerows and planting of shelterbelts could reduce the impact of the wind. However, tree planting should not take place on dune systems, heathland or on land that could be restored to dry grassland or heathland. | Establish strips of permanent uncultivated grassland, scrub or woodland alongside watercourses to capture sediment run-off.<br><br>Manage the timing of cultivation to avoid the compaction of soils.<br><br>Introduce strips such as beetle banks within large exposed fields on the plateau to bind the soil and reduce wind erosion.<br><br>Ensure that soils are left bare for the minimum period possible during cultivation, to reduce wind and water erosion.<br><br>Manage existing hedgerows to allow them to fill out, and plant into gaps to create continuous hedges.<br><br>Restore and introduce hedgerows in areas most prone to wind erosion, for instance on the limestone plateau on top of the Edge.<br><br>Introduce tree planting in key locations on the plateau to reduce wind speeds, but avoiding planting on sandy soils where the restoration or creation of lowland heathland would be more appropriate. | |

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| **Pollination** | Semi-natural habitats<br><br>Road verges<br><br>Hedgerows | There are 297 ha of dry acid grassland, 131 ha of calcareous grassland and 52 ha of lowland heathland. These semi-natural habitats will provide some nectar sources for pollinating insects, as do the hedgerows and woodlands. However, they are limited in extent and distribution.<br><br>Many of the roads have wide verges with some flowering plants. | Local | Pollinators play a vital role in food provision, pollinating crops such as oilseed rape, field beans and potatoes, but research shows that their numbers have declined sharply. Providing suitable nectar sources at a landscape scale and the habitat structures required for other stages of their life cycles should help to address this, thus supporting pollination which is vital to many crops.<br><br>The management of hedgerows to ensure flowering, along with species-rich margins alongside, will also support pollinating insects, in turn benefitting productivity. | Encourage floral and structural diversity within arable systems, by establishing networks of margins alongside watercourses, tracks, hedgerows and woodlands, using wild bird seed or nectar flower mixes and managing to create species-rich grasslands.<br><br>Identify and protect through appropriate management those stretches of road verge with structural diversity and nectar flower species.<br><br>Encourage management of road verges throughout to improve their species richness and structural diversity.<br><br>Encourage the management of hedgerows to allow them to fill out and flower, and to develop a diversity of both shrubby and herbaceous species. | **Pollination**<br><br>**Food provision**<br><br>**Climate regulation**<br><br>**Biodiversity**<br><br>**Sense of place/ inspiration** |

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| **Pest regulation** | Semi-natural habitats<br><br>Hedgerows | There are limited areas of semi-natural habitats, including broadleaved woodland, heathland and grassland. Fields are divided by hedges in most places, but these hedges are often tightly clipped and gappy. | Local | It is anticipated that different pathogens and pests will be able to thrive under new climatic conditions[16]. Semi-natural habitats within productive agricultural landscapes can support species which prey on pest species, thus regulating the potential damage to crops. Hedgerows can similarly support a range of predator species. | Strengthen network of hedgerows so that they provide habitat for predator species throughout the farmed area.<br><br>Manage and expand semi-natural habitats so that they can support predator species.<br><br>Introduce strips such as beetle banks within large exposed fields on the plateau to aid soil erosion reduction as well as provide habitat for pest regulators. | **Pest regulation**<br><br>**Food provision** |
| **Regulating coastal erosion and flooding** | The hard limestone outcrops at the Humber Estuary at Whitton | A combination of high river flows with high tides can result in an increase in water levels in the estuary.<br><br>A major realignment scheme has been undertaken to provide extra flood storage on the estuary at Alkborough, and a further scheme is planned for Flixborough Grange, both sites just below the Edge on the River Trent, to the north west of this NCA. | Local | While coastal erosion and flooding are major issues along the Humber Estuary, they are unlikely to be major issues within this NCA, as it includes only the stretch where the relatively hard limestone edge drops down below the Humber.<br><br>Along the coastline on the north boundary most of the existing defences along the estuary are unlikely to need major repairs for 20 to 40 years [17].<br><br>**Continued on next page...** | Improve infiltration of rainfall through increasing areas of permanent grassland, woodland, and other semi-natural habitats, thus reducing rapid run-off which contributes to high water levels in the Humber Estuary. | **Regulating coastal erosion and flooding** |

[16] *UK Plant Science: Current status and future challenges,* UK Plant Science Foundation/Society of Biology (URL: https://s3-eu-west-1.amazonaws.com/sbwebsite/pdf/UK_Plant_Science-Current_status_and_future_challenges.pdf; accessed February 2014) [17] *The Humber Flood Risk Management Strategy Summary Document*. Environment Agency (March 2007).

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| **Regulating coastal erosion and flooding cont.** | | | | **... continued from previous page**<br><br>However, there is uncertainty about the rate at which sea levels will rise and the defences deteriorate, so there is a risk of flooding of the low-lying land at Whitton Ness, just to the north-east of this NCA, in the future. This would impact on farmland between Whitton, West Halton and Winteringham.<br><br>This is best addressed through the management of the Humber Estuary; there is only limited potential to undertake measures to address this within this NCA, for instance by improving infiltration rates so that the impact of run-off is reduced. | | |

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| **A sense of place/ inspiration** | Limestone cliff<br><br>Arable landscape<br><br>Open limestone plateau with airfields<br><br>Long views<br><br>Small villages of local limestone<br><br>Lincoln and its cathedral<br><br>Scunthorpe and its steel works | Sense of place is provided by the large-scale limestone plateau landscape with its west facing scarp known as the 'Cliff' and its gentle eastward sloping dip slope. The windblown sands of the Coversands give rise to localised areas of open heath, unusual inland sand dunes, oak/birch woodland and some conifer plantations.<br><br>The exposed landscape of the plateau is occasionally broken by shelter belts of beech and sycamore often sheltering the dispersed large farmsteads.<br><br>The industrial town of Scunthorpe dominates the northern part of the NCA, with its ironstone extraction and steel works, while Lincoln, with its prominent cathedral forming a dramatic landmark on top of the Cliff, dominates the south.<br><br>On the higher ground there are only a few settlements, linked by long, straight roads with wide verges. Along the foot of the scarp slope are villages of local honey coloured limestone and red or brown tiled roofs.<br><br>**Continued on next page...** | Regional | This is predominantly an arable landscape, but with many distinctive features, not least the sandy habitats on the Coversands, and the airfields along the top of the limestone cliff. These bring contrasts in the sense of openness and enclosure.<br><br>The plateau is predominantly a large scale arable landscape, which contrasts with the more mixed farming, parklands and hedges of the lower-lying land at the foot of the scarp.<br><br>Past exploitation of ironstone, sand and limestone now make significant contributions to local landscapes, with a range of habitats from open water, grassland, heathland and woodland providing opportunities for recreation and access as well as enhancing biodiversity. | Maintain, manage and expand the mosaics of lichen and lowland heathland and oak/ birch woodland on the sandy soils of the Coversands.<br><br>Strengthen network of hedgerows.<br><br>Ensure that schemes for the restoration of ironstone, sand and limestone quarries include the creation of habitats such as heathland, calcareous grassland and oak/birch woodland thus strengthening these elements within the landscape and enhancing biodiversity interest.<br><br>Manage road verges to provide greater floristic interest.<br><br>Manage small woodlands and seek to increase their broadleaf content.<br><br>Ensure that opportunities to enjoy the long views out to the west from the scarp slope and to Lincoln Cathedral are made available, and not obstructed. | **Sense of place / inspiration**<br><br>**Food provision**<br><br>**Regulating soil erosion**<br><br>**Pollination**<br><br>**Sense of history**<br><br>**Recreation**<br><br>**Biodiversity**<br><br>**Geodiversity** |

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| **A sense of place/ inspiration cont.** | | **... continued from previous page**<br><br>While some airfields along the Cliff top have been given over to other uses, the RAF base at Scampton is home to the Red Arrows, as well as the legendary 'Dambusters'.<br><br>Senses of inspiration and escapism are likely to be associated with the long views afforded from the Cliff along the western edge, as well as the long distance views to Lincoln Cathedral. | | | | |

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| **Sense of history** | Prehistoric burial mounds and linear boundary features<br><br>Roman roads and settlements<br><br>Norman cathedral in Lincoln<br><br>Medieval villages and town houses in Lincoln; deserted villages<br><br>Ironstone and limestone quarries<br><br>Parklands<br><br>Steelworks<br><br>Airfields | There is a clear line of visible archaeological evidence present along the Edge, including prehistoric burial mounds, linear boundary features and trackways. Ermine Street, a long straight Roman road, links the crossing point of the Humber with the fort and later colonia at Lincoln. Medieval influence is reflected in the city walls, town houses and churches below the prominent Norman cathedral of Lincoln, and the dispersed settlement pattern and occasional deserted villages.<br><br>Later historical influences include the development of Scunthorpe as a 19th-century centre of iron and steel production, and a number of country houses with estates in particular along the west side of the area. In the 20th century a number of airfields were established on the plateau. | National | The ground features of prehistoric and medieval times are at risk of being lost through cultivation. Key sites should be identified and protected by the establishment of permanent grassland.<br><br>The distinctive long straight roads dating from Roman times form the basis of the current road networks.<br><br>Even the features of the 20th century, which might be perceived by some as intrusive, have their own historic interest and significance. Thus the massive structures of the steelworks at Scunthorpe are widely visible and have now become iconic, while the airfields along the top of the Cliff are a significant part of Britain's military history, playing a key role as bomber bases. RAF Scampton is the home of 617 Dambuster Squadron and the Red Arrows. Their histories and features warrant protection and interpretation where possible.<br><br>**Continued on next page...** | Seek opportunities to protect ground features by ceasing cultivation and establishing permanent grassland, and providing interpretation where possible.<br><br>Maintaining the open character of the limestone plateau including appropriate redevelopment of disused airfields, re-using their technical and domestic infrastructure and protecting features of historic interest.<br><br>Where appropriate, provide access to sites of historic interest along with interpretation to improve enjoyment and understanding of local history.<br><br>Ensure that restoration of limestone, ironstone and sand extraction sites retains features of historic interest where appropriate, along with interpretation to improve understanding of their contribution to the history of the area. | **Sense of history**<br><br>**Regulating soil quality**<br><br>**Climate regulation**<br><br>**Sense of place/ inspiration**<br><br>**Recreation**<br><br>**Geodiversity** |

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| **Sense of history cont.** | | | | **... continued from previous page**<br><br>At first sight the area might not appear to have many historic features, but they do exist and much could be done to make them accessible where appropriate and provide interpretation to improve enjoyment and understanding of the many layers of historic periods that go to make the landscape of today.<br><br>Vernacular buildings reveal evidence of past uses, structures and materials, such as the local limestone, and restoration/ conversion should respect this historic evidence, using appropriate materials and techniques.<br><br>There is scope for protecting and restoring the historic features within the estates and parklands, including veteran trees.<br><br>The city of Lincoln, with its Roman artefacts, the cathedral, the cluster of medieval town houses on the slopes below it, and other artefacts from medieval times, is a key tourist destination. | Enable visitors to appreciate the history of the RAF and skills of the Red Arrow pilots, through information and maintaining safe locations to watch them.<br><br>Maintain the settlement pattern and the historic character of villages, farmsteads and estates, including through sensitive development and the re-use of redundant buildings.<br><br>Protect stone-built vernacular architecture, using appropriate materials and techniques when restoring or converting.<br><br>Protect and restore historic features within parklands, including ancient and veteran trees, and providing opportunities for quiet recreation where appropriate.<br><br>Ensure access, recreation, tourism and education continue in the historic city of Lincoln, supporting local businesses and ensuing a sense of history is a shared with residents and tourists. | |

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| **Tranquillity** | Cliff top, long views<br><br>Woodlands, heathlands | A sense of tranquillity is most likely to be associated with the broadleaved woodlands of the scarp slopes and the heathlands, grasslands, sand dunes and woodlands of the Coversands. Long views over adjacent low-lying land can also contribute.<br><br>There has been a significant decline in tranquillity in the past 50 years, with a fall in the total 'undisturbed' area of the NCA from 73 per cent in the 1960s to 44 per cent in 2007. | Local | Scunthorpe and the M180 have the most significant impact upon tranquillity in the north, while tranquillity is further affected by the active airfields, the A15 that runs north–south and the urban areas of Lincoln in the south.<br><br>The noise and activity generated by the airfields can be a source of excitement, with the practice sessions of the Red Arrows in particular attracting many viewers. | Expand and connect semi-natural habitats, in particular heathland, broadleaved woodland and acid and calcareous grasslands, to provide more extensive opportunities to enjoy tranquillity.<br><br>Protect and manage locations on the cliff edge that provide extensive views out over the Humberhead Levels and Trent and Belvoir Vales to the west. | **Tranquillity**<br><br>**Sense of place/ inspiration**<br><br>**Recreation**<br><br>**Biodiversity** |

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| **Recreation** | Public rights of way, including long distance trails<br><br>Woodlands, heathlands<br><br>Restored extraction sites<br><br>Local Nature Reserves<br><br>Airfields<br><br>Parklands | Access to the countryside is possible through the rights of way, at a density of 0.5 km per km², and including long distance footpaths such as the Viking Way, Roman roads and green lanes.<br><br>With 255 ha of open access land, and accessible woodlands, the total publically accessible land amounts to just 2 per cent of the NCA. One airfield now provides for leisure uses, and in the north, some of the restored sand and ironstone extraction sites, such as at Messingham, offer open water and semi-natural habitats for both informal quiet recreation and organised sports. | Local | Restored extraction sites such as at Messingham, and the Normanby Hall Country Park, now provide opportunities for access and recreation in the north of the area. The Ironstone Way is a circular route around the fringes of Scunthorpe.<br><br>However, more could be done to ensure that the urban populations of Scunthorpe, Gainsborough and Lincoln have better access to the surrounding countryside, for instance by creating more links to existing paths. Around Scunthorpe in particular, there are a number of woodlands, heathlands, restored extraction sites and open access areas that could be better connected, where appropriate, to provide more choice of routes. | Ensure that restoration of disused extraction sites incorporates open access and opportunities for quiet recreation where possible.<br><br>Create more links between urban populations and the surrounding countryside, finding links between existing accessible sites and semi-natural habitats, especially woodlands, for use by walkers, cyclists and horse riders.<br><br>Extend the Ironstone Way and develop more links and circular routes to improve access for the population of Scunthorpe.<br><br>There may be opportunities to negotiate improved access to parklands and estates where appropriate. | **Recreation**<br><br>**Sense of place/ inspiration**<br><br>**Sense of history**<br><br>**Tranquillity**<br><br>**Biodiversity**<br><br>**Geodiversity** |

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| **Biodiversity** | Small part of Humber Estuary SAC, SPA and Ramsar site<br><br>17 Sites of Special Scientific Interest (1 per cent of the area)<br><br>123 local wildlife sites<br><br>Local Nature Reserves | There are nearly 2,000 ha of priority habitats within the NCA including broadleaved woodland, lowland heathland, lowland dry acid grassland and lowland calcareous grassland. Other small areas of priority habitat include purple moor grass and rush pastures, reedbeds, wet woodland, and flood plain grazing marsh.<br><br>The NCA contains a small part of one SAC, one SPA and one RAMSAR site (the Humber Estuary) and 459 ha are nationally designated as SSSI. | Regional | There are few designated sites and they tend to be dispersed, for example, Manton and Twigmoor SSSI comprises several separate units on the Coversands near Greetwell. The mosaics of habitats, especially the heathland and dry acid grassland that have developed on the Coversands are of particular significance, being close in type to those of Breckland. The lichen content is often rich, and grasslands often contain a proportion of heather species. Historic air pollution may have affected the swards especially at Risby Warren. Nationally rare species include woodland and grayling butterfly. These habitats need to be managed to protect and enhance their biodiversity interest, through managing grazing levels and controlling scrub and bracken encroachment.<br><br>Improving the management of priority habitats, and finding ways to extend and connect them, will all assist in making them more resilient to the effects of climate change, and will to an extent allow for species movement.<br><br>**Continued on next page...** | Encourage landowners and managers to restore heathland and dry acid grassland, by for example re-introducing grazing and management that will control the spread of scrub and bracken, to maintain and enhance their condition.<br><br>Seek opportunities to buffer, extend and connect semi-natural habitats, to improve their condition and resilience and enable species movement.<br><br>Ensure that existing oak/birch woodlands are under sound management that will improve their condition and enhance their biodiversity interest, including supporting natural regeneration of native broadleaved species.<br><br>Where there are existing plantations, priority should be given to the creation/ restoration of heathland or dry acid grassland where these habitats can be restored, with compensation planting sites found elsewhere. | **Biodiversity**<br><br>**Climate regulation**<br><br>**Regulating water quality**<br><br>**Regulating soil quality**<br><br>**Regulating soil erosion**<br><br>**Sense of place/ inspiration**<br><br>**Tranquillity**<br><br>**Recreation** |

| Service | Assets/ attributes: main contributors to service | State | Main beneficiary | Analysis | Opportunities | Principal services offered by opportunities |
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| **Biodiversity cont.** | | | | **... continued from previous page**<br><br>Priority should be given to extending and connecting the existing areas of heathland and dry acid grassland on the sandy soils. Opportunities for grazing, recreation and game shooting could all be incentives to encourage landowners to restore heathland.<br><br>Oak/birch woodland is significant here, and there is still scope for removing conifer plantations and restoring to heathland where possible. Some ancient woodland sites have been planted up and steps could be taken to restore them to a more natural composition of native broadleaves of a wide age range. There are some small areas of mire, wet heathland and wet woodland which need to be buffered to protect their hydrology.<br><br>Where the underlying limestone is close to the surface, and in disused limestone quarries, small areas of calcareous grassland have developed. These tend to be small and dispersed.<br><br>The restoration of sites where minerals (limestone, ironstone, and sand) have been extracted should include the establishment of priority habitats (heathland, grassland, woodland) along with open water and other freshwater habitats where groundwater levels are high.<br><br>**Continued on next page...** | Protect and manage areas of mire, wet heathland and wet woodland, and negotiate with landowners to bring adjacent land into management to buffer the hydrological conditions.<br><br>Identify areas of calcareous grassland, and seek to expand, buffer and connect them, thus making more resilient.<br><br>Ensure that restoration of extraction sites includes the establishment of priority habitats where possible, and manage to improve the contribution they make to biodiversity and to local landscape character.<br><br>Establish networks of permanent, unfertilised species-rich grassland alongside watercourse, roads, tracks and hedgerows throughout the farmed land, to support farmland birds and connect semi-natural habitats.<br><br>Restore and introduce hedges in the farmed land, to strengthen the networks of connecting habitats, while also reducing erosion of soils by wind. | |

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| **Biodiversity cont.** | | | | **... continued from previous page**<br><br>A stronger network of grasslands and hedgerows within the farmland would benefit birds such as lapwing, skylark, corn bunting, linnet and barn owl, as well as supporting brown hare. Increasing the connectivity of habitats in this way would also enable species movements.<br><br>The wide road verges also offer opportunities to improve the biodiversity interest, thus contributing to the network of linking habitats through the farmed land.<br><br>Due to the porous nature of the limestone, there are few watercourses on the plateau, but springs and flushes occur where the water meets underlying impermeable layers. These can create significant wildlife habitats within the farmed land.<br><br>River straightening along the Ancholme and its tributaries has reduced their value for wildlife, and measures to allow them to follow more natural courses could improve the biodiversity interest by introducing more structural diversity into the river habitats, while also reducing the energy of flood flows and increasing the storage capacity of flood flows. | Encourage mixed farming which will introduce more managed grasslands thus improving conditions for more farmland birds and hares.<br><br>Manage the wide road verges so that they develop structural and species diversity.<br><br>Identify, maintain and enhance existing springs and flushes on the edges of the limestone.<br><br>Identifying opportunities to allow the River Ancholme and its tributaries to follow more natural courses, introducing more structural diversity into the river habitats, thus also reducing the energy of flood flows and increasing flood storage capacity. | |

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| **Geodiversity** | Jurassic limestone scarp<br><br>Underlying ironstone<br><br>Windblown sand deposits<br><br>5 geological Sites of Special Scientific Interest<br><br>25 Local Geological Sites<br><br>Fossil assemblages of the Frodingham Ironstone | The underlying Middle Jurassic Lincolnshire Limestone is clearly evident through the scarp slope along the west side of the NCA, with a gentle dip slope falling eastwards to the Central Lincolnshire Vale. In the north, the resistant Frodingham Ironstone within the early Jurassic Lias Group gives rise to a second scarp. These resources gave rise to the steel industry and associated industrial development around Scunthorpe, and the limestone provides an important aquifer.<br><br>Post-glacial windblown sands, the Coversands, have formed distinctive sandy landscapes of heathland in the north of the area, with inland dune formations clearly visible at Risby Warren and Messingham Heath Sites of Special Scientific Interest.<br><br>Other geological SSSIs include Greetwell Hollow Quarry, with exposures of stratigraphic significance; Manton Stone Quarry, with clear exposures of the Lower Lincolnshire Limestone Formation, and Cliff Farm Pit, with coral fauna evident within a layer of Kirton Shale. | National | The resources of limestone, ironstone and sand have been exploited over time, and disused quarries and extraction sites now provide geological exposures and geomorphological features that contribute to scientific research and understanding, as well as offering opportunities for wider education and awareness raising.<br><br>There are internationally important and well preserved examples of ammonites in some quarries in the Frodingham Ironstone, which have enabled correlations to be made with successions in Somerset, Dorset and Normandy, thus facilitating an understanding of depositional history.<br><br>The distinctive dune formations at Risby Warren need to be protected and managed to ensure that the dune systems can be studied and understood.<br><br>**Continued on next page...** | Ensure that new restoration schemes include the protection of features of geological interest and make them accessible where possible, providing interpretation to improve understanding of geological processes.<br><br>Maintain exposures within existing sites.<br><br>Manage the dune systems at Risby Warren so that the distinctive formations can be seen and understood, providing interpretation to raise awareness of their geomorphology.<br><br>Maintain and restore field boundaries made from limestone rubble.<br><br>Use local building materials and techniques when restoring vernacular buildings. | **Geodiversity**<br><br>**Sense of place/ inspiration**<br><br>**Sense of history**<br><br>**Biodiversity** |

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| **Geodiversity cont.** | | | | **... continued from previous page**<br><br>Many of the vernacular buildings – farmhouses, barns, village houses, walls and churches – are built with local limestone, thus making evident the links between underlying geology and historic development. In the same way, the steelworks in Scunthorpe arose from the exploitation of local resources of ironstone and limestone.<br><br>By allowing the River Ancholme and its tributaries to follow more natural courses, geomorphological processes can develop, while also reducing flood flows and enhancing biodiversity interest. | Find ways of allowing the River Ancholme and its tributaries to follow more natural courses, thus allowing geomorphological processes to occur.<br><br>Provide access to sites of interest, along with information about their geological and geomorphological features, and how they have contributed to the development of the landscape we see today, where possible. | |

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Front cover: On the plateau, farms and fields are large, based on cereals and root crops with few hedges and just occasional woodlands on the sandy deposits. © Natural England/Nancy Stedman

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