

National Character Area profiles – and geology



Naomi Stevenson

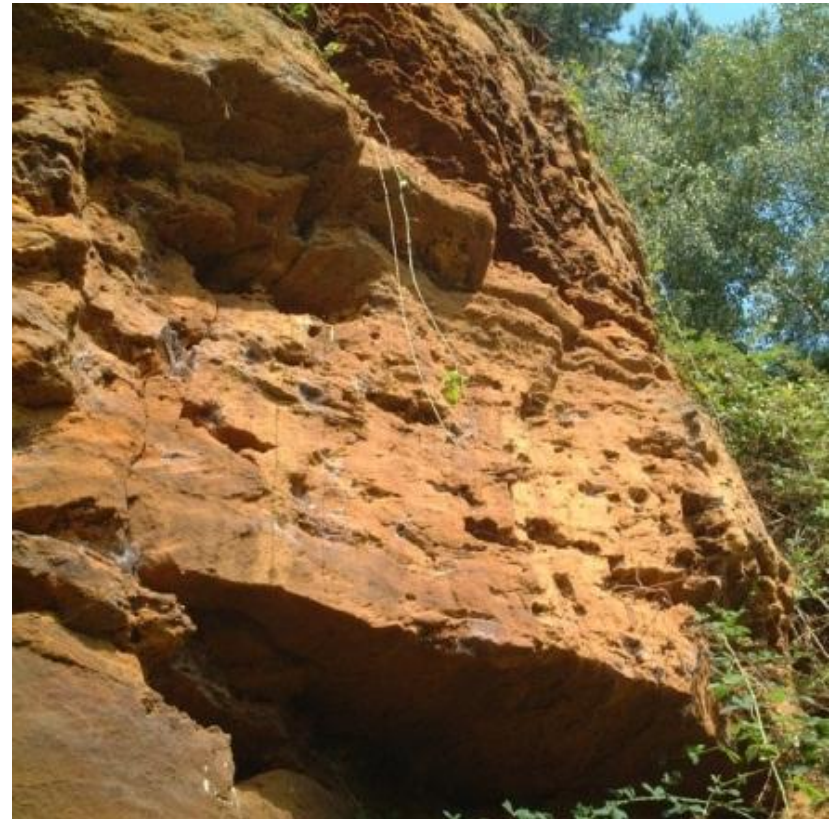


Introduction



In the next 15 minutes I will:

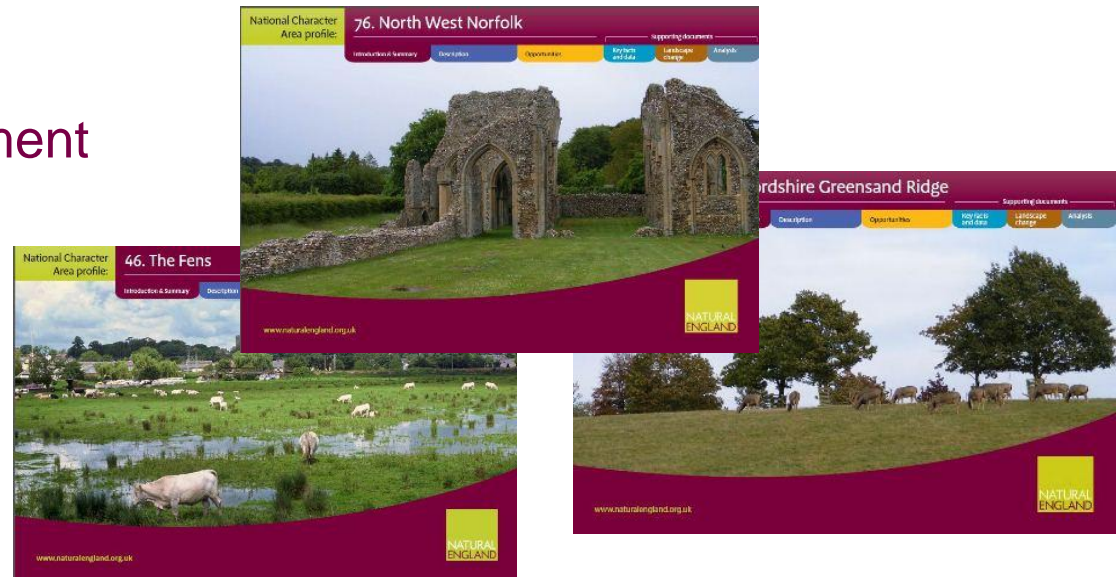
1. Briefly(!) outline the background of the National Character Area project
2. Outline how the NCAs mirror England's geology
3. Present a whistlestop tour of our geology
4. Outline how Earth Science is an integral part of the profiles



Background to National Character Area profiles

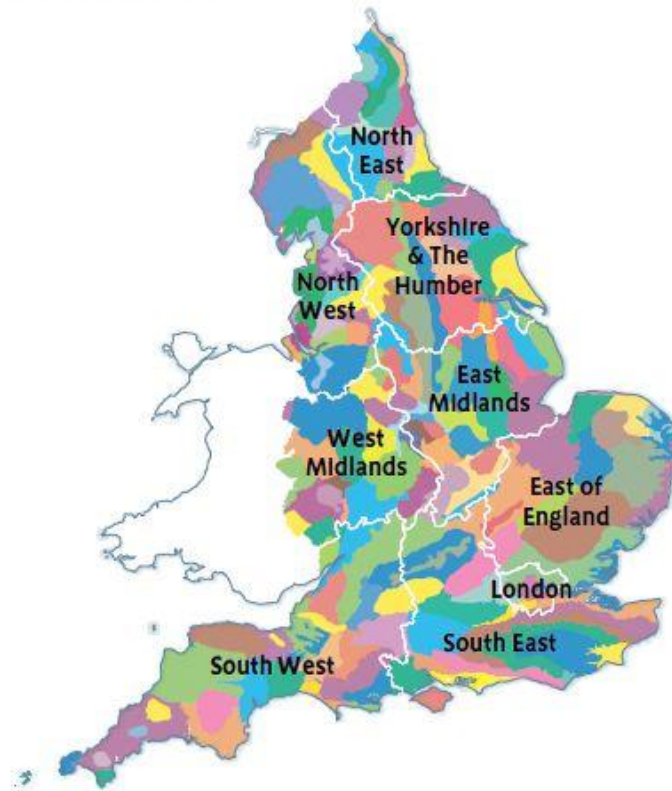


- Jan 2008 – earlier work (from late 1990s) rebranded as National Character Areas via SoNE
- Mar 2010 – update of the NCA framework approved as part of implementing the ELC
- July 2011 – Natural Environment White Paper published
- July 2012 – draft ‘Key facts and data’ documents published for all NCAs
- June 2014 – all 159 profiles published.

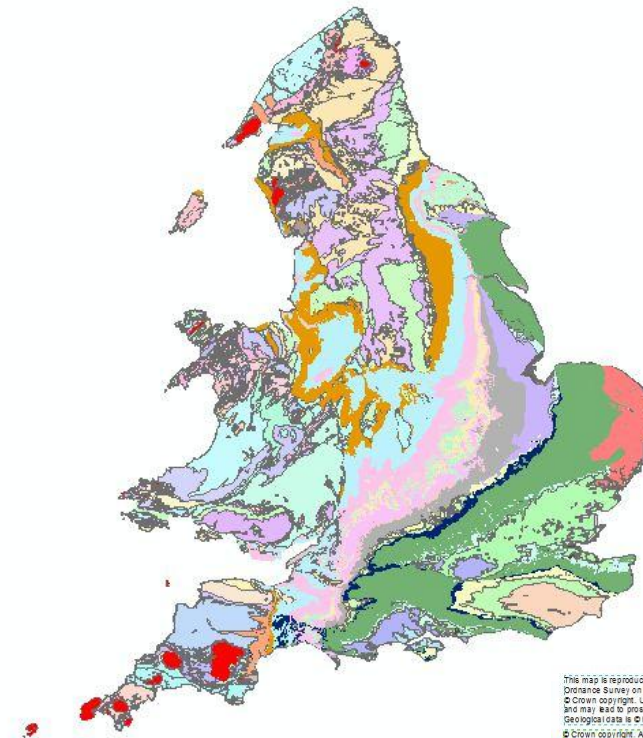


Peas in a pod... the NCAs mirror our geology

National Character Areas map

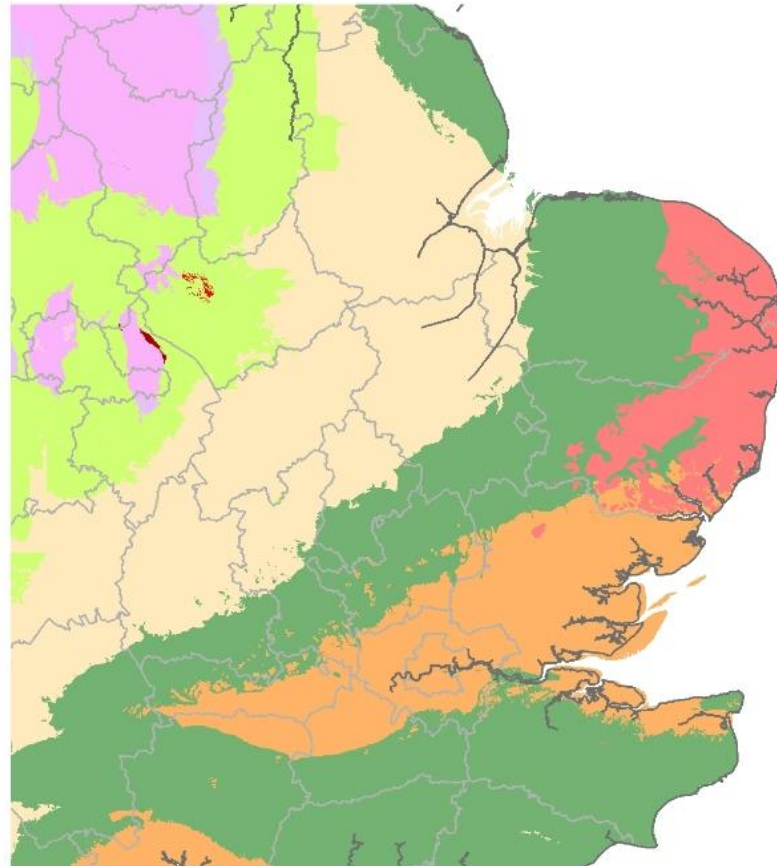


Bedrock geology



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East Anglia: A whistlestop tour



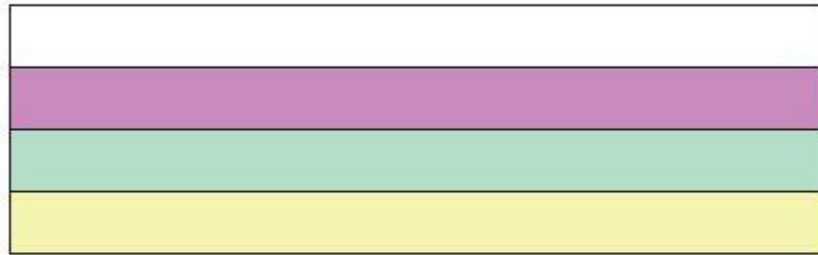
- Quaternary
- Neogene
- Palaeogene
- Cretaceous
- Jurassic
- Triassic
- Permian
- Carboniferous
- Devonian
- Silurian
- Ordovician
- Cambrian
- Precambrian

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Our strata... laid down

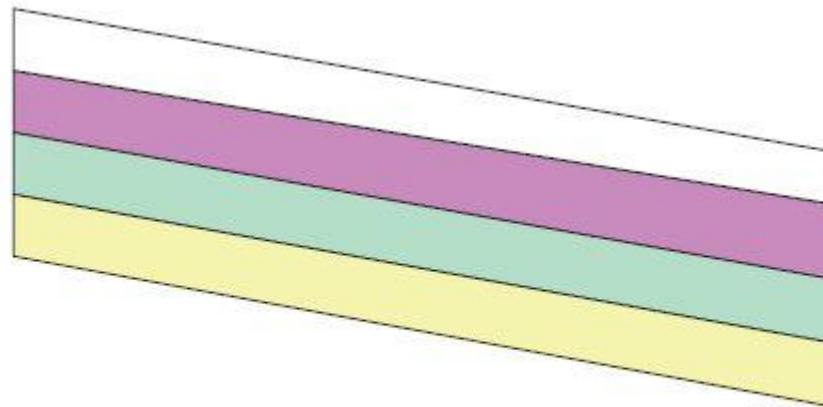


If you drew a line from Peterborough to Hunstanton...



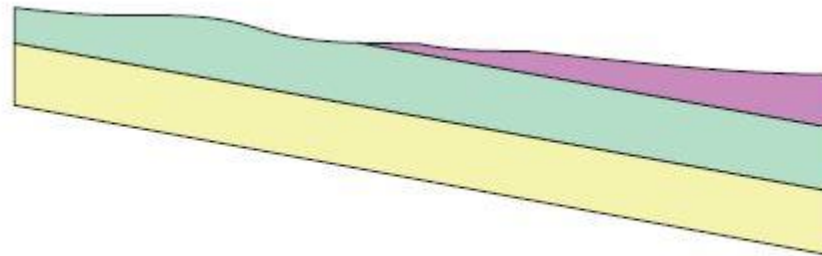
Our strata... laid down and tilted

Then, as a result of tectonic forces...



Our strata... laid down, tilted and eroded

Erosion exposes deeper strata



Hunstanton Cliffs



Our geology...



- So what do we have??

The power of ice



“Ice can do what whatever it wants!”

Dramatic faults



Amazing fossils



Ecosystem services: What has (local) geology ever done for us?



- Shown us the Earth's history locally
- Stones and bricks to build our houses
- Glass to let in light
- Stored water for us to drink
- Metals for our tools

Ecosystem services: What has (wider) geology ever done for us?



- Minerals including Rare Earths
- Petrol and oil derivatives
- Graphite for pencils
- Kaolin, added calcium

Ecosystem services: Geology provides the substrate for life

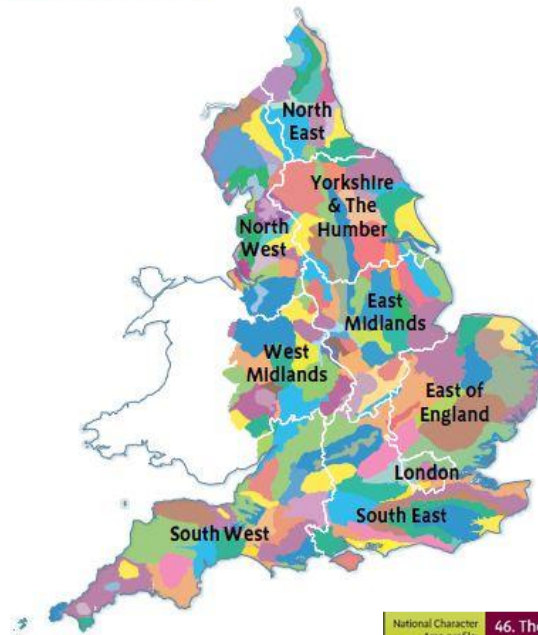


- Variations in geology mean variations in biodiversity
- Minerals in soils
- Provides different exposure to light...
- Limestone pavement
- Chalk grasslands



So, NCAs...

National Character Areas map



National Character
Area profile:

90. Bedfordshire Greensand Ridge

Supporting documents

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Summary & SEOs

National Character Area profile:

90. Bedfordshire Greensand Ridge

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Summary

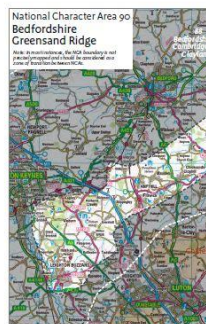
The Bedfordshire Greensand Ridge National Character Area (NCA) is a narrow ridge running north-east, south-west, rising out of – and entirely surrounded by – the Bedfordshire and Cambridgeshire Claylands NCA. It is a distinctive ridge with a north-west-facing scarp slope, formed by the underlying sandstone geology which has shaped the landscape and industry of the Ridge. Its historic landscapes, including the farmland, parklands and historic architecture, combined with small settlements, greenbelt and woodlands ancient and modern, give parts of the NCA a more timeless feel than the Bedfordshire and Cambridgeshire Claylands which surround it.

There is a patchwork of semi-natural habitats throughout the NCA, including flood plain grazing marshes, lowland heathland and meadows and mixed deciduous woodland.

The north-west-facing scarp slope, with its mix of coniferous and deciduous woodland, pasture, arable and heathland, overlooks Milton Keynes and the Marston Vale, forming a significant landscape feature from a distance. There are a number of fine panoramic views over the surrounding landscape.

Food, timber and biomass provision on the Ridge are regionally important, and the Ridge is nationally important for recreation: Woburn Abbey and its associated safari and deer parks are well known and attract visitors from far and wide, as do other houses and estates along the Ridge – Haynes, Shuttleworth, Sandy Lodge and Southill. The historic houses, both great and small, with their vernacular architecture, are of significance.

The main pressures on the NCA are (or would result from) development, non-local materials, increased congestion and increased light pollution.



Click map to enlarge

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National Character Area profile:

90. Bedfordshire Greensand Ridge

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Statements of Environmental Opportunity

- **SEO 1:** Protect, manage and enhance the historic landscape and its wealth of sites of heritage interest, including the remnant ridge and furrow, iron-age hill forts, designed parklands and associated country houses, estate villages, farmsteads and houses using traditional building material, for their contribution to landscape character and as a recreational and educational resource.
- **SEO 2:** Manage the agricultural and woodland resource and priority habitats for the benefit of biodiversity, landscape character and the economy.
- **SEO 3:** Protect the Ridge's aquifer, the river valley landscape of the Flit, Ivel and Ouzel to benefit biodiversity, prevent soil erosion, improve river flow and quality, support pollinators and protect and enhance wildlife and recreational corridors.
- **SEO 4:** Promote and protect the distinct character and geodiversity of the Greensand Ridge landscape, with its prominent sandstone ridgeline rising from the surrounding low-lying vales; protect the long open views and high levels of tranquillity to ensure continued enjoyment of the landscape and plan for the sustainable extraction and restoration of sites associated with the distinctive geology.



Haynes Park Mansion.

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Physical and functional links to other National Character Areas

The Bedfordshire Greensand Ridge National Character Area (NCA) is entirely surrounded by the Bedfordshire and Cambridgeshire Claylands NCA. The dominant and highly visible north-west-facing scarp slope with its mix of coniferous and deciduous woodland, pasture, arable and heathland overlooks Milton Keynes and the Marston Vale; the ridge offers fine panoramic views out over the surrounding landscape, including reciprocal views of and from the Chilterns to the south. The undulating dip slope is relatively gentle with shallow dry valleys generally sloping southwards. It is the marked contrast between this island of Greensand and the encircling Clayland vales and low hills over which it rises that makes the area both attractive and distinctive within the wider setting.

The porous nature of the Woburn Sands, a major constituent of the Lower Greensand Group, makes it an important aquifer supplying potable water and water to agriculture and industry to both this and nearby NCAs. The rivers Flit and Ouzel rise in the Chilterns, the Ivel in the East Anglian Chalk; all pass through the periphery of the area to join the Great Ouse, including drainage from the north-west-facing escarpment in the middle of the NCA which flows to the Elstow Brook. Although much straightening and deepening has been carried out, there are still traditional flood meadows, acid mires and wet woodland in the valley floors which form corridors of riparian habitat linking the Greensand Ridge and the Bedfordshire and Cambridgeshire Claylands NCAs. The Flit largely forms the southern boundary of the NCA. There is much boating activity on the Grand Union Canal which cuts through the west of the



View from the Ridge to the Claylands.

NCA and connects all the NCAs between London and Birmingham; this is also an important route for walkers and cyclists.

The Bedfordshire Greensand Ridge NCA is bisected by the East Coast Main Line railway with trains running between London and Peterborough stopping at Sandy; the Midland Mainline via Bedford to London St Pancras runs through the NCA with a station at Flitwick, and the West Coast Main Line nips the western extremity of the NCA with London Midland trains stopping at Leighton Buzzard. The M1 motorway runs through the Ridge, with junctions just north and south of it, with the A1 cutting through near Sandy. The A6 runs north-south through and from Bedford and Luton, with the A5 cutting through the south-west between Dunstable and Milton Keynes. The western end of the NCA is part of the greenbelt around Luton.

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The landscape through time

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90. Bedfordshire Greensand Ridge

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The Bedfordshire Greensand Ridge has a dispersed settlement pattern. The settlements are restricted to small groups. Movement between settlements along the Ridge involves a series of narrow winding roads and sunken lanes, often with rough verges of bracken.

The major towns in the area (Leighton Buzzard and Sandy) are generally located towards the edge of the escarpment. Ampthill, however, although it has effectively merged with Flitwick to the south, sits in the middle of the area behind the Ridge, adjoining Ampthill Great Park.

Many older buildings are constructed from distinctive local stone. The varied traditional building materials include brick, thatch and sandstone, including occasional dark brown ironstone – the latter being found in the churches around Ampthill. The combination of ironstone and green or orange sandstones in buildings such as churches is unique. Locations with more diluted 'Greensand' character correspond to pockets of chalky Boulder Clay (glacial till) which overlie the sandstone.

Recreation is important here. In addition to the major attractions of Woburn Abbey and its attendant deer and safari parks, horse riding is popular and there are many pony paddocks across the Ridge. The wooded Greensand Ridge Walk is increasingly popular and the Grand Union Canal is used for boating, walking and cycling. The Lodge (now the UK headquarters of the Royal Society for the Preservation of Birds (RSPB)), Shuttleworth and Rushmere Country Park are also popular recreational facilities. A new Centre Parc is opening in 2014.

The landscape through time

The Lower Greensand Group, including the Woburn Sands, was laid down in shallow tropical straits between two landmasses 124–112 million years ago during the Cretaceous Period. In some places, ash deposits from volcanoes active in north-west Europe at this time have subsequently been altered to become what are now localised patches of fuller's earth found at Woburn Sands village and Clophill. Subsequently, Gault Clay and Chalk were deposited on top of the Woburn Sands with the whole succession then tilted and eroded to create the scarps and vales of the Greensand Ridge that are such a feature of the Bedfordshire landscape today.

Locally extensive glacial clay deposits and associated sands and gravels overlie the Cretaceous rocks. These sediments were deposited during the Anglian glaciation (approximately 290,000 years ago) when the area was covered by an ice sheet from the north. The area was not covered by ice sheets of later glaciations but was affected by the fluctuating interglacial (temperate) and glacial (tundra-like) climate, the latter leading to extreme periglacial erosion. Alluvial sand and gravel were deposited in the Ouzel valley and peat deposits have subsequently been laid down in the Flit valley.

The well-drained soils of the Greensand Ridge led to it being extensively settled and cleared of much of its tree cover early in Neolithic times. There is evidence of bronze-age activity near Flitwick and of iron-age hill forts at Sandy, Wavendon and Heath and Reach.

Roman settlement was extensive, with small towns attached to the major Roman roads passing through the area at Sandy and south of Milton Keynes, and a wider pattern of small farming settlements and villas (for example, Shefford). Roman finds have been made in the Haynes and Flitwick areas while the present-day A5 follows the line of the Roman Watling Street.

Key facts and Data section

National Character Area profile: **90. Bedfordshire Greensand Ridge**

Supporting documents: Introduction & Summary, Description, Opportunities, Key facts and data, Landscape change, Analysis

2. Landform, geology and soils

2.1 Elevation

The Bedfordshire Greensand Ridge is a large scale elevated landscape providing extensive views across the surrounding Bedfordshire and Cambridgeshire Claylands. The lowest points are found in the valleys at around 20 m, the highest in the south west near Leighton Buzzard at over 150 m with a gentle drop towards Gamlingay in the north-east.

Source: Natural England (2010)

2.2 Landform and process

The sands and sandstone of the Bedfordshire Greensand Ridge were laid down in shallow tropical seas in the Cretaceous Period. Deposition of volcanic ash at this time has given rise to localised patches of fuller's earth (a clay mineral that has particular absorbent properties).

Tilting during the Alpine Orogeny (mountain building period) followed by millions of years of erosion has given rise to the scarps and vales that are such a feature of this area of Bedfordshire as well as small areas of both Buckinghamshire and Cambridgeshire.

The ice ages of the last million years covered the area with ice sheets increasing the erosion and leaving behind the glacial tills and boulder clay that still shroud the underlying greensand in many areas. The Greensand, being made up of more resistant sands, was not eroded as much as the surrounding softer clays and when the ice retreated, the Greensand Ridge was left as a prominent feature on the landscape.

Source: Natural England (2010)

2.3 Bedrock geology

The Greensand Ridge is dominated by the Greensand Group, laid down in the Cretaceous Period around 124-112 million years ago. It is extraordinarily rich in fossiliferous marl and famous Shenley Limestone. A thin Massif to the north-east and area 'Bedfordshire Straits', this shelf is a result of marine flooding from the north. The layers of fuller's earth found produced by a series of volcanic eruptions from the sea that covered what is now contains a clay mineral with part used to extract the grease from the name. More recently, fuller's earth is used in the production of paper.

Source: Natural England (2010)

2.4 Superficial deposits

Extensive glacial clay deposits and associated sands and gravels overlie the Cretaceous rocks. These sediments were deposited during the Anglian glaciations (approximately 290,000 years ago) when the area was covered by an ice sheet from the north.

In the Flit valley between Flitwick and Clophill there are extensive deposits of peat that are important both agriculturally and for supporting biodiversity.

Source: Greensand Ridge Natural Area Profile; Bedfordshire and Greensand Ridge Countryside Character Area Description

2.5 Designated geological sites

Tier	Designation	Number
National	Geological Site of Special Scientific Interest (SSSI)	2
National	Mixed Interest SSSI	0
Local	Local Geological Sites	15

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

Much of the Bedfordshire Greensand Ridge is located on Cretaceous sands and sandstones, which give rise to acidic, nutrient poor, free draining soils. These are lower in fertility than the surrounding claylands. This has influenced the vegetation and agricultural activities of the area, making it more suitable for the establishment of hunting estates comprised of heath and mixed woodland than

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Source: Greensand Ridge Natural Area Profile; Bedfordshire and Greensand Ridge Countryside Character Area Description

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

Grade	Area (ha)	% of NCA
Grade 1	609	2
Grade 2	5,553	20
Grade 3	12,593	46
Grade 4	2,980	11
Grade 5	N/A	N/A
Non-agricultural	4,186	15
Urban	1,415	5

Source: Natural England (2010)

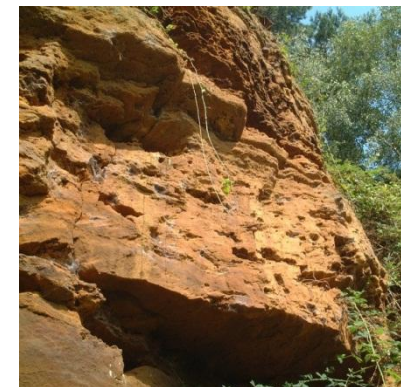
■ Maps showing locations of Statutory sites can be found at: <http://magic.defra.gov.uk/website/magic/> - select 'Landscape' (shows ALC classification and 27 types of soils).

National Character Area profile:

90. Bedfordshire Greensand Ridge

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Service	Assets/ attributes: main contributors to service	State	Main beneficiary	Analysis	Opportunities	Principal services offered by opportunities
Geodiversity	<p>Striking landform that clearly reveals geological processes</p> <p>Natural exposures</p> <p>Geological and mixed interest SSSI and Local Geological Sites</p> <p>Quarries – fullers earth and high-quality sands</p> <p>Vernacular building stone</p>	<p>The geological importance of the Greensand Ridge is underlined by the SSSI designated for their geological interest and by 15 Local Geological Sites.</p> <p>The bedrock geology dates from the Cretaceous Period but two of the Local Geological Sites also have Quaternary interest.</p> <p>The Greensands include a thin layer, the famous Shenley Limestone, at their top; this is extraordinarily rich in fossil marine shell species, especially brachiopods.</p> <p>High-quality sands from the ridge are used for glassmaking and fuller's earth, originally used to remove grease from sheep's wool, is currently used in a variety of chemical processes.</p> <p>Local stone is important here as a distinctive building material.</p>	National	<p>The underlying Cretaceous geology of the Lower Greensand Group gives the Ridge its distinctive landform and has influenced the NCA's social and economic history and provides the route for the Greensand Walk.</p> <p>Exposures of rock, especially those designated as SSSI or Local Geological Sites, are important for the geology and geological processes they reveal. The fossil fauna of the Shenley Limestone is important for the biology it reveals.</p> <p>Local stone is an important resource – vernacular buildings such as churches would be difficult to repair or renovate without bringing stone long distances.</p>	<p>There are opportunities to maintain views of and access to geological features and exposures where appropriate, improving access to cuttings, quarries and other exposures of geological features for increased understanding and enjoyment of geodiversity as well as for uncovering fossils and stratigraphy of major importance.</p> <p>Seek opportunities to interpret the geology to enhance the Greensand Ridge Walk.</p> <p>Maintain resources such as small-scale quarries for the repair and renovation of local vernacular buildings.</p>	<p>Geodiversity</p> <p>Sense of place/ Inspiration</p> <p>Sense of history</p> <p>Recreation</p>

Leading to...

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SEO 1: Protect, manage and enhance parklands and associated country recreational and educational resources.

For example, by:

- Conserving historic buildings and vernacular materials.
- Protecting the area's distinctiveness to major commuting routes, villages and towns within an area that is changing the intrinsic character.
- Maintaining historic feature routes, traditional walls and trees, wood pasture, hedgerows.
- Promoting sustainable access to the Grand Union Canal.
- Promoting the importance of the Greensand Ridge through recreation.
- Protecting and maintaining the area in the planning system and schemes, to ensure that the area remains distinctive.
- Promoting, as appropriate, the restoration of areas where these have been in decline. Managing these areas where original parkland features are lost.

SEO 4: Promote and protect the distinct character and geodiversity of the Greensand Ridge landscape, with its prominent sandstone ridgeline rising from the surrounding low-lying vales; protect the long open views and high levels of tranquillity to ensure continued enjoyment of the landscape and plan for the sustainable extraction and restoration of sites associated with the distinctive geology.

For example, by:

- Identifying and conserving key geological features, including quarry exposures of Greensand and Gault (for example, Double Arches Pit SSSI and Nine Acres Pit SSSI).
- Preserving exposures of the local stratigraphy for research and education as well as for their aesthetic value.
- Demonstrating the history of mineral extraction within the NCA, for building stone, high-quality sands and fuller's earth.
- Creating and promoting interpretation of, and access to, geological features and assets of the area, highlighting links to other interests including historic earthworks, local building materials, distinctive habitats, flora and fauna.
- Working to agree restoration plans and management agreements between landowners, operators and the Minerals Planning Authority for existing and former extraction and quarry sites that demonstrate geological, landscape, biodiversity and public access benefits, including those where extraction of nationally scarce minerals such as fuller's earth has taken place.
- Promoting the importance of smaller-scale locally distinctive features such as acidic mires, that are a feature of the local geology.

Where to access the National Character Area profiles



The profiles are available on the Natural England website:

<http://www.naturalengland.org.uk/publications/nca/default.aspx>

Background information, references, glossary and sources of information are also available:

<http://www.naturalengland.org.uk/publications/nca/background.aspx>

Access maps showing NCAs with local administrative boundaries, Water Framework Directive catchments and protected landscapes can be seen on the NCA homepage:

<http://www.naturalengland.org.uk/publications/nca/>

External partners can register to download the NCA boundary layer from our GIS database