

# **Breckland**

**Prepared and edited by Stephen Rothera**

## **The vision for the future**

We seek a Breckland where there is a vigorous working landscape, in which decisions consistently favour wildlife, to protect and develop a countryside richer in habitats and species characteristic of the area, for the appreciation and understanding of people.

There are extensive well-grazed, open heather and grass heaths equivalent, at least, to the area present in 1945, through management of existing heaths and targeted re-establishment of new ones, thereby safeguarding some of Breckland's most characteristic wildlife.

Natural water regimes are restored wherever feasible, to all Breckland wetlands of wildlife value and to recover groundwater-fed systems degraded by past drainage, abstraction insufficient management, poor water quality or inappropriate river maintenance, to sustain Breckland's wetland heritage.

The multi-use forestry approach creates a Thetford Forest where a fifth of the area supports characteristic Breckland habitats of significant wildlife value, through management of existing sites and targeted creation of habitat, especially heathland, for the benefit of wildlife and the enjoyment of people.

Environmentally sustainable farming systems are developed which contribute to wildlife conservation in the NA by reducing reliance on inputs, especially spray irrigation, fertiliser and pesticide use, to expand habitats of importance for characteristic Breckland wildlife, particularly birds, plants and insects.

There will be a sharing of information and expertise which will allow more integrated action amongst those who determine the land-management of Breckland, seeking especially to involve those who live and work in Breckland in deciding its future.

There is a landscape in which there will be long-term survival of Breckland's nationally and internationally important species through habitat management and re-creation, together with a selected programme of re-introductions based on sound knowledge of their needs.

## Foreword

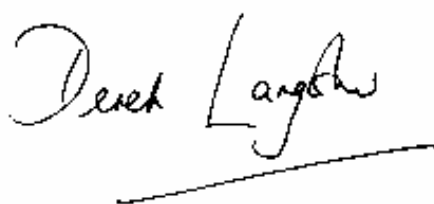
One of the key components of English Nature's *Strategy for the 1990s* has been the Natural Areas approach. We examined the local distinctiveness of each part of England, to identify their characteristic wildlife and natural features, and used this to define a comprehensive series of Natural Areas. Their boundaries are based on the distribution of wildlife and natural features, and on the land use pattern and human history of each area, and thus offer a more effective framework for the planning and achievement of nature conservation objectives than do administrative boundaries. They are **not** designations.

Wildlife is not restricted to designated and protected sites such as nature reserves or SSSIs; it occurs throughout the countryside, coast and built up areas of England. No part of the country is without some wildlife interest. The Natural Areas approach gives us a way of determining priorities for nature conservation areas with ecological and landscape integrity, and to set objectives which reflect these priorities. Together, all Natural Areas provide a powerful vision for nature conservation right across England.

The achievement of the objectives described for each Natural Area will be a key part of our new strategy *Beyond 2000*. The objectives will guide our work over the coming years, and we hope Natural Areas will allow us to help others in achieving what is best for nature conservation locally.

This Natural Area profile is one of a series of 120, one for each Natural Area. In it we describe the wildlife and natural features of the area, and what makes it special and distinctive. Each Natural Area profile is different, since it describes and reflects the local distinctiveness of the area, and therefore includes nature conservation objectives which are particular to that area. The profiles have been written after a wide range of local consultations, both on the boundaries of the Natural Areas themselves and on these profiles.

We hope you will find this document useful, and look forward to working with you to maintain and enhance the wildlife and natural features of England.

A handwritten signature in black ink that reads "Derek Langslow". The signature is written in a cursive style and is positioned above a horizontal line.

Dr Derek Langslow  
Chief Executive

## Preface

'Breckland' is an invention, and a comparatively modern one at that. The name is just a century old. Yet, the land of flint, sand, and water it describes has an ages old identity, a very particular land-use history and a richly distinctive wildlife, which sets it apart from all surrounding landscapes. W G Clarke who coined the term Breckland, wrote

“Few of the lowland districts of England have more striking individual characteristics than the area known as Breckland, which comprises about 400 square miles, of which 253 are in South West Norfolk and 145 in North West Suffolk....”

This profile document is a description and evaluation of the wildlife and geological features of the Breckland natural area. It seeks to summarise what is both characteristic and special about Breckland, to draw out those issues which significantly affect Breckland's wildlife and set out objectives for sustaining that heritage.

A natural area is not a designation, but an area of countryside identified by its unique combination of physical attributes, wildlife, land-use and culture. These features give a natural area a “sense of place” and a distinctive nature conservation character, which we should seek to sustain. The natural areas concept is an important part of English Nature's role, as statutory adviser to government in stimulating action to protect and increase the wildlife of England. The profile is written for everyone with an interest in wildlife conservation in Breckland. It seeks to draw together conservation organisations, local communities and statutory bodies to focus on the top priorities for conservation and to work towards the achievement of shared objectives.

This is not an action plan. It does highlight areas where co-operative action locally will work towards achieving the objectives nature conservation organisations share.

By acting locally to conserve the biological diversity of Breckland we shall contribute to the UK goals on 'biodiversity'. In 1992 over 150 world leaders signed the convention on Biological Diversity at Rio de Janeiro. They did so to express a shared belief that action must be taken to halt the world-wide loss of animal and plant species and genetic resources. At the same time they agreed to draw up national plans and programmes and to share resources to help implement them. This resulted, in 1995, in Biodiversity, the UK Steering Group Report which lists species of conservation concern in the UK as well as costed action plans for 14 key habitats and 116 key species. This profile highlights the many key habitats and species found in Breckland. In due course local Biodiversity Action Plans will be produced and the natural area profiles will provide the context for these local actions to protect and enhance threatened wildlife.

We hope readers of this document will recognise the need to protect and expand wildlife, share the vision and ask, what can I, my community or organisation contribute towards a wildlife-rich, sustainable Breckland for the future.

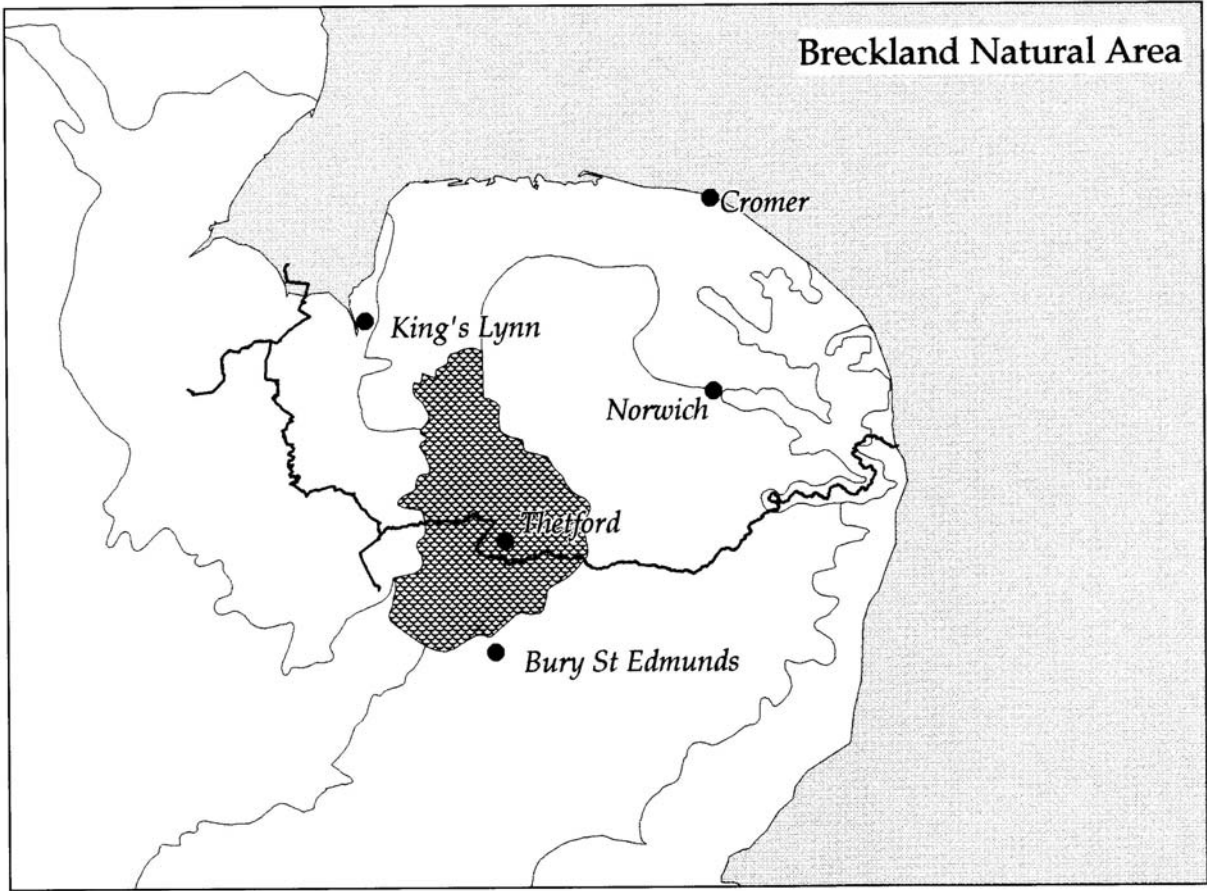
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# 1. Introduction

## The Breckland Natural Area

A natural area is not a designation, but an area of countryside identified by its unique combination of physical attributes, wildlife, land-use and culture. These features give a natural area a 'sense of place' and a distinctive nature conservation character. English Nature through wide consultation has identified 120 natural areas in England and the seas around our coast. One of these is Breckland. The area fits well with the natural areas concept, having a distinctive combination of soil type, climate, land-use history and therefore a landscape and wildlife which sets it quite apart from neighbouring areas. These are the Fens to the west, the East Anglian Plains to the east, North Norfolk to the north and the East Anglian Chalk to the south. Natural areas transcend administrative boundaries and enable nature conservation priorities and actions to be set in an ecological framework. Breckland, as described in this profile, is synonymous with the Breckland character area shown on the joint English Nature and Countryside Commission Character Map of England.

## Description

Breckland lies on a low part of the chalk spine which extends from north west Norfolk to the Chilterns. The natural area is a low plateau that reaches its highest point of 59 metres near Rymer Point in Suffolk. The underlying chalk is topped by varying depths of windblown sand and in places boulder clay between chalk and sand. Soils are complex, but typically very sandy free-drained mixes of chalk, sand, silt, clay and flints occur, which show marked pH variation within short distances. This has a profound influence on the natural vegetation and arable agricultural practices.

Breckland's climate is described as semi-continental. East Anglia, as a region, is the driest part of the British Isles. Breckland however also experiences greater extremes of temperature than neighbouring districts including late spring frosts that can severely affect both crops and natural vegetation. In fact Breckland has the coldest meteorological station below 300 metres in the British Isles, which has often recorded the lowest monthly extreme temperature; no month being free of frost.

These two factors, climate and soil, define Breckland, mould its farming and through centuries of man's activities have created its landscape. Breckland is distinguished from neighbouring natural areas by the following; North Norfolk with its more maritime climate; the East Anglian Plains which has generally heavier clay soils, the Fens with its flat landscape, organic fen peat soils and tidal silts, and the East Anglian Chalk which has different chalk soils and sharper topography.

Several authors have defined the extent of Breckland. All differ slightly in how wide to cast the boundary. The one used here (map 1) encompasses most previous definitions and takes account of soil type, land-use history and the resultant landscape. Breckland thus defined extends from near Narborough in the north to Risby and Kentford in the south. The western boundary essentially follows the Fen edge and the eastern boundary runs from Swaffham, South Pickenham, via Watton to East Harling, Garboldisham and Ixworth Thorpe. Defined on a 1km square basis the Breckland natural area is 1,038 square kilometres in extent.

No hard boundary can exactly define a natural area. The fenland edge where the Breckland sands reach down to the peats is sharply distinctive. Where the natural area boundary directly crosses the valleys of the Little Ouse and Wissey, Breckland too encloses black soils. The river Nar forms a convenient northern boundary, yet historically Massingham Heath further to the north supported Breckland plant specialities before being converted to arable. The nearby East Walton Common (also in the North Norfolk natural area) is a fine example of pingo pools considered more typical of Breckland. The most transitional boundary is the eastern side between Swaffham and Ixworth; here especially, the soils, land-use and history blend into those of the East Anglian Plains. Similarly, modern agricultural practices have blurred the boundary between the East Anglian Chalk and Breckland.

### **This Profile**

Breckland has a rich wildlife heritage, but has experienced extraordinary change and loss of wildlife species and their habitats in just the last 50 years (Lambley 1994). The nationally important wildlife and geological sites of Breckland, the Sites of Special Scientific Interest, cover 8,529 hectares or 8% of the natural area, including the Stanford Training Area. To this can be added the area of non-statutory sites of natural area importance, the County Wildlife Sites, which total roughly 2,980 hectares. These sites together with the open space habitats of wildlife importance of Thetford Forest and the Breckland chalk rivers makes just over 11.5% of the natural area which has vegetation of high or significant wildlife importance. This contrasts sharply with the 29% which was heath alone in 1900.

The profile identifies important plant and animal species found in Breckland many of which are characteristic of the area and rare or absent elsewhere in Britain. A measure of Breckland's importance for species is the proportion of those listed as being of conservation concern in the UK Biodiversity Steering Group Report. Including bird species, Breckland has populations of at least 169 out of 1,250, or 13.5% of the internationally important, most rapidly declining or threatened species identified by the report. These are listed in Appendix 2 and highlighted in relevant chapters. The Biodiversity Action Plan list is not however exhaustive. Species whose national or international status and trends are uncertain have been excluded, including a number of species found in Breckland and nowhere else in the UK. Local Biodiversity Action Plans will be produced for Norfolk and Suffolk which will translate national priorities to the local level.

The following chapters describe each of the key wildlife features or habitats in Breckland, consider their origins and fate and assess their national and international importance before defining nature conservation objectives for each. A section then describes those areas of action or research needed to sustain and improve the wildlife of Breckland.

Each chapter sets out the relevant broad objectives for the future, unconstrained by the present pressures or difficulties wildlife faces. Underpinning these and the whole of this profile are four principles.

- **Environmental Sustainability** This means maintaining the environment's natural qualities and characteristics and its capacity to fulfill its full range of functions. These include maintaining the diversity of life. This will be achieved through a sound understanding of the natural environment, its processes and functions and working with rather than against these. Where there is inadequate understanding or the impact of activities on wildlife the precautionary principle should be adopted.

- **Conserving biological diversity** This requires the protection, and enhancement where possible, of the whole range of variation of living organisms. The typical and characteristic must be conserved as well as the rare and threatened if the wildlife heritage of Breckland is to be passed down to future generations.
- **Community support and understanding** This means sharing the importance of Breckland's wildlife and wild places to as broad an audience as possible. Wide understanding of the needs of wildlife will support action to meet those needs, and for the management required to improve habitats to sustain species in the long term.
- **Co-operative action** It is essential that all those who appreciate Breckland's wildlife heritage share their knowledge and expertise. Breckland is a fortunate natural area in that this already happens to a marked degree. The possible partners identified in the profile should look for new and effective ways to share information and work together to deliver the objectives outlined here.

### **Overview Nature Conservation Objectives**

- Ensure the sustainable use of land, air and water in Breckland to underpin the full diversity of life in the natural area.
- Achieve the conservation of the full diversity of living organisms in the natural area to pass on to future generations, especially that for which Breckland is characteristic and important.
- Gain wide community support and understanding of the needs of wildlife and wild places in Breckland.
- Strengthen co-operative action between all sections of the community to achieve shared objectives for Breckland's wildlife heritage.

## **2. The geological character**

Over millennia Breckland has experienced both tropical seas and arctic tundra to produce the geological character and landforms of the area today.

Breckland's bedrock is Cretaceous Middle and Upper Chalk, deposited as a pure limestone in tropical seas between 100 and 65 million years ago. This is covered by, often thin, sandy glacial drift left behind when the Anglian ice sheet covered the area around 400,000 years ago.

Much later this Anglian drift material was re-worked under the prevailing tundra-like conditions of the last glacial period 100,000 - 12,000 years ago. This left a cover of windblown sediments which through freeze/thaw processes on the chalk which was close to the surface, led to Breckland's characteristic striped soils of alternating acid sands and alkaline chalk. On level ground intense tundra activity sorted the sediments to create patterned ground. In aerial photographs these features look like fingerprints in the grass heath vegetation and soils of ploughed fields.

Other characteristic features of the Breckland natural area are the shallow depressions termed pingos. These also date from tundra-like conditions in the last Ice Age. Pingos form as groundwater collects, freezes and builds up beneath the surface creating a domed feature. As the climate warms, the ice melts and the dome collapses, leaving a crater in the centre of the pingo and sandy ramparts around the rim. Many of the pingos in Breckland are filled, or partially filled with water due to their close relationship with the groundwater table. The Breckland pingos are of a particular type indicating the presence of ground ice during the Ice Age. These features are important for the clues they give us to the processes and conditions prevalent when they were formed.

Another active process has been the effect of water on the chalk bedrock which has resulted in the formation of so called karstic depressions or swallow holes, which may be evident on the surface or hidden beneath the glacial deposits. The famous fluctuating Breckland meres, such as Ringmere or Fowlmere, may be connected to this karstic drainage, although the exact process of formation and age of the features has not yet been established. Several theories have been suggested to explain their formation including surface water drainage, pingo development or collapsed underground caverns.

Breckland also has an important Geoarcheological interest, with flint deposits being exploited by early man as a source of material to fashion stone implements.

Nationally important palaeolithic sites, some associated with the geological interest of the area, place Breckland at the forefront of British paleolithic study.

## **Evaluation of the Earth Science Resource**

Breckland is considered notable for its geological interest and has some quite unique features.

Several sites of special scientific interest (SSSI) in the Breckland natural area clearly demonstrate the importance of the Ice Age and its part in the evolution of the landscape. Thetford Heath and Grimes Graves both contain excellent examples of patterned ground whilst at Beeches Pit at West Stow sections are evident through the sequence of glacial deposits. Deposits of tufa (calcium carbonate) which provide information on the drainage pattern, flora and fauna of the environment during the last 1.6 million years are also revealed at Beeches Pit. The Stanford Training Area SSSI provides good examples of the development of karst landforms such as chalk swallow holes, e.g. the Devil's Punch Bowl.

Three major pingo systems remain in the natural area, at Foulton, Thompson and East Harling commons. East Harling Common is the smallest system with around 20 pingos, the largest of which is like a permanent mere. Thompson Common has the highest density of pingos and, just ahead of Foulton, is the most extensive. Similar pingo systems occur at other sites such as at Hills and Holes (Great Hockham), Breckles Heath and Frost's Common now largely covered by forestry plantations. These are making interpretation here difficult. The Breckland pingos were originally part of a much wider belt which formed at the southern - most edge of the ice sheet, the majority of which have been lost through agricultural activities on the land. Nowhere else in Britain and Ireland are such extensive periglacial features visible.

The fluctuating Breckland meres are unique hydrological and geomorphological forms which are not found anywhere else in Europe as far as is known. Twelve semi-permanent meres are recorded, all in Norfolk, whilst a number of additional shallow depressions on heaths hold water in unusual years. In the past there may have been more as revealed by Faden's 1797 map of the county.

Many of these geological features have outstanding biological interest too as described in later chapters.

### **Breckland issues and current factors**

- Existing sites need to be effectively managed to retain and enhance their geological exposures
- At some sites there is potential for conflict between management of the geological and biological interests.
- Afforestation of pingo sites either by plantations or gradual tree and scrub encroachment can lead to infilling and the obscuring of pingos. Careful tree removal and after-management is needed to re-expose the features whilst avoiding damage to the ramparts.
- Many heathland sites with periglacial patterned ground have been ploughed out this century. There is a need to manage Breckland soils and vegetation to preserve this geomorphological resource where it still occurs.
- Opportunities exist to promote interpretation and understanding of the geology of Breckland.

### **Conservation Objectives**

- Promote jointly the geological, archeological, and biological interest of sites to achieve support and understanding for the geology, landscape history and ecology of the Natural Area.
- Maintain existing geological features to protect their interest and provide sites for study and appreciation by a wide community.
- Assess new sites in permanent or temporary exposure such as pits and cuttings to improve knowledge and provide additional opportunities for study.
- Recover, where appropriate, presently afforested pingo sites by tree removal, to secure their geological and biological value.

Management, research and monitoring priorities	MAFF	English Nature	Farmers/Landowners	Local Authorities	Local Communities	Conservation Organisations
Ensure all SSSIs with important geological features have full Management Plans or Site Management Statements which integrate geological, archeological and biological interests.		●	●	●		●
Encourage protection and restoration of relict periglacial features such as patterned ground, pingo systems and karst landforms, through Management Plans and the use of agri-environment schemes.	●	●	●	●	●	●

### 3. Heathlands and grass heaths

#### Description

Breckland is undoubtedly best known for its heather and grass heaths, which together with associated disturbed habitats provide wildlife communities unique within the British Isles. Four primary forces have moulded this landscape; soil type, soil disturbance, a dry frost-prone climate, and grazing by sheep together with that Breckland denizen, the rabbit.

The greatest extent of Breckland heaths today are centred on the Elveden Estate in Suffolk and the Stanford Training Area to Brettenham Heath area in Norfolk. Several other important sites are found near Thetford, such as Barnham Cross Common. The remainder are relatively small scattered survivors of formerly extensive areas.

Heather and grass heaths are best treated as a single complex as differences in soil type, over sometimes quite small distances, result in a mosaic of vegetation types from calcareous to acid grasslands. This may mirror underlying patterned ground and soil striping or simply the depth of the overlying sands and the degree to which these have been leached of their chalky elements. Alex S Watt's pioneering studies in the 1930s and 1940s on the dynamics of these communities is a milestone in the history of plant ecology. He showed that soil type was the most significant differentiating factor between the five main grassland types (A-E) which he distinguished. They range from very shallow, highly calcareous, moderately nutrient rich soils (A) to deep acidic heavily leached sands, poor in nutrients (E).

A brief description must suffice. The most calcareous, grassland (A) occurs naturally at Lakenheath Warren and at a number of other sites where chalk has been brought to the surface by man, notably Deadman's Grave, Thetford Heath and Little Heath Barnham. It has a broken turf of sheep's fescue and bare ground on very shallow soil with many lichen and spring flowering annual plants. Species with poor competitive ability are favoured including Breckland specialities such as wall bedstraw, Breckland thyme and rare lichens including

starry Breck lichen and scaly Breck lichen. Grassland (B) is the Breckland variant of the chalk pasture of the Downs and Chilterns. It is more widespread than (A), occurring at Lakenheath Warren, Weeting, Foxhole and Deadman's Grave on deeper less calcareous soils. It has a continuous moss-rich sward with up to 80 species of plants including chalk grassland species such as purple milk-vetch, purging flax, squinancywort and hairy rock-cress. The yellow flowering spikes of lady's bedstraw are common in summer with white field mouse ear and common stork's bill. Grassland (C) is similar and is also widespread. It is species poorer (about 60) on deeper soils where leaching allows more acid loving species such as heath bedstraw and shepherd's cress. In grassland (D) the sward is acid grassland, rich in sheep's fescue, common bent, and sheep's sorrel in a mosaic with many Cladonia lichens. Grassland (E) develops on the deepest acid sands where Cladonia lichens dominate with only about 20 other species.

Heather may grow in soil types (B-E) and may dominate on deep acid soils, as it does at Berner's Heath where it achieves almost a 100% cover. Heather is also abundant at Cavenham Heath, Knettishall Heath and at Ling Heath and Hopton Point in the Stanford Training Area. Such heather-rich heathlands with wood sage, lichens and mosses are not typical in Breckland.

A combination of soil type, dry conditions, hard frosts, heather beetle and possibly atmospheric pollution tend to favour grass rather than heather heath formation. Very heavy rabbit grazing also converts heather heathland to grass heath as is known now at Cavenham Heath and at Weather Heath in the past.

Such a neat classification belies the mosaic nature of grass-heath vegetation on most heathlands. This is due to both soil conditions and land management history. Stands of bracken, well suited to acid soils, cover large areas of heaths. Gorse and broom are also abundant on acid sites, with developing birch or pine woodland in ungrazed situations on a range of soils. Close-grazed grass heaths are periodically ablaze with yellow ragwort whilst abandonment of grazing on richer sites favours the purple flowered rose bay willow herb.

Breckland's history of windblown sand has left fixed inland sand dunes which are often dominated by sand sedge, a species otherwise found only on coastal dunes. The last remaining mobile sand systems in Breckland occur at Avenue Farm Breck and at Wangford Warren where blown eroded sand and lichen heath is Britain's only inland home to grey hairgrass.

Soil disturbance is also key to maintaining the grass heaths. Sheep grazing alone does not maintain conditions suitable for the characteristic Breckland communities with their abundant lichens, winter annuals and cushion forming mosses. From the thirteenth century commercial rabbit warrens were established in Breckland. It is their feral descendents which have a profound effect on the vegetation producing open, sparse conditions for many of the natural area's plant and animal specialities to survive. Moles also help create such conditions through casting up molehills.

The Breckland Heaths are famously home to many rare plant and animal species. Heathland also supports more common yet characteristic species. Skylarks are a distinctive sound of spring time Britain. The wheatear, which nests in rabbit holes is another characteristic open heath species, although presently in decline. Stone curlews are the emblem of Breck heaths to which the equally rare woodlark is slowly returning as a nesting species through expansion

from its strongholds on clearfells in Thetford Forest. Other examples include common curlew which breeds on grass heaths where the sward is not heavily grazed and the occasional whinchat pair breed on heaths with scattered bracken and heather. One or two heaths are important winter roost sites for hen harriers. Breckland heaths are dry and warm in summer, ideal for many species of insects. The turf teems with ants, spiders, beetles and solitary bees/wasps on hot summer days. Characteristic butterflies include brown argus and dingy skipper on the chalk; small copper, grayling and green hairstreak from acid heaths. Over 40 species of moths are recorded on calcareous heath, whilst ling pug, lunar yellow underwing, and fox moth are examples of over 20 species which require the acid heaths. The mottled grasshopper is another characteristic grass heath species.

Amongst the mammals stoats and foxes are common predators of rabbits on Breckland heaths. Brown hares are also commonly seen on some larger estates where a mix of heathland, dry grassland, wooded shelter belts and arable provide food and shelter. Adders too occur on Breckland heathland but are nowhere common.

## **Influences Past and Present**

Change has been part of the Breckland scene from man's first attempts at clearance of the lightly wooded ground in the Neolithic Period. Ever since the Bronze Age, the area has been a largely treeless, open landscape, of heathland, arable and wetland, which formed an integrated system of land use developed over centuries. Sheep grazing has been a constant presence since prehistoric times and from the Middle Ages the development of extensive commercial rabbit warrens was a major agricultural employment. Warrens were maintained up to World War II when the Lakenheath Airbase was developed on the last remaining example. Intense grazing by rabbits and sheep were the major factors in the development of the Breckland vegetation and helped maintain the open ground conditions that so many plants and animal species depend upon. Accounts of Breckland from the sixteenth century onwards refer to part of the area as a desert, with drifting sands, doubtless caused by the overgrazing of sheep flocks and rabbits. Known for centuries as sheep and rye country, a traditional form of agriculture developed whereby some heaths or "breaks" were broken up for arable cultivation in times of agricultural prosperity and allowed to revert to heath when soils were exhausted or prices fell. The term Breckland however was first coined by W G Clarke as recently at 1894 although a "breck" was understood two centuries earlier as "a piece of land which having lain uncultivated is ploughed again one year" (John Ray 1673).

Change this century has been prodigious. In 1900 heathland and dry grassland covered 29,000 hectares compared with about 7,000 hectares at present. Large scale reclamation began in the 1920s when social and economic changes following World War I led to over 21,000 hectares of poor cheap land being converted from shooting Estates to conifer plantations. Much of this took place on the old warrens and other heaths. Renewed interest in agriculture from the 1920s onwards saw heaths reclaimed for arable cropping leaving the remaining heaths as a fragmented, isolated resource. Fragmentation is damaging because large sites contain a greater variety of habitats and are more ecologically robust than smaller sites; that is they can support a greater variety of typical species through time. Populations on small sites can be easily destroyed e.g. by fire and may not recolonise because of isolation. World War II military training also claimed heathland such as the airfields at Lakenheath and East Wretham Heath, but also allowed "tumble down" from arable. In 1950 the area was still 14,000 hectares. Today STANTA includes a crucial two thirds of all the remaining heathland and dry grassland in Breckland.

The quality of remaining heaths deteriorated for several reasons, especially the decline of rabbit numbers following myxomatosis in 1954. Intensively grazed heaths became densely vegetated within two years, and although numbers recovered they remain generally below pre-myxomatosis levels. This period also allowed pine, birch and other scrub invasion to commence. Harvesting of heathland products; gorse, bracken and heather ceased probably early this century, allowing further invasive change to occur. Stock grazing declined too, as specialised arable farming developed dependent on spray irrigation. The planting of Thetford Forest will have ameliorated the climate by increasing humidity.

The quality of Breckland's heaths now rely on beneficial "agri-environment" support mechanisms especially the largely successful Breckland ESA scheme. Encouragement is also given under the scheme to expand the area of heathland by reversion from arable, although take-up requires considerable incentives to outweigh modern cropping and pig rearing practices and profits.

Insidiously, Breckland's remaining heaths may be harmed by the pollution from nitrogen compounds deposited in rain and from the air. This nitrogen produced by urban and intensive livestock sources can fertilise the heaths altering the vegetation from for example, heather to grass. Wind blown fertiliser drifts from fields also affect the edges of important heathland sites.

## **Evaluation of the Wildlife Resource**

The heaths of Breckland, form a habitat complex unique within the British Isles. The dry heathland and chalk grass heath are of international importance, qualifying Breckland as a candidate Special Area of Conservation under the EC Habitats and Species Directive. Comparable European Heathlands with an affinity to Breckland such as the area around Mols (North East Denmark), Luneburg Heath (Germany), and around Fontainebleau (South of Paris) frequently lack the calcareous grass heath.

These heaths and grasslands are home to a highly characteristic group of plant specialities, rare lichens, ground nesting birds and invertebrates, all of which are of outstanding importance. All rely on sparse vegetation with some degree of soil disturbance to survive. Rabbit grazing has been fundamental to maintaining them.

Breckland is acknowledged to be of European importance for its three renowned bird species, stone curlew, woodlark and nightjar. About 65% of the British stone curlew population nest in Breckland, half on heathland; some 40% of all woodlarks in Britain nest in Breckland including 20% of these on heaths. Very few nightjars nest on heathland, preferring instead conditions on Thetford Forest clearfells. These three qualify Breckland for designation as a Special Protection Area under the EC Birds Directive. Breckland heaths are also important breeding sites for the Red Data Book (RDB) species wheatear, whinchat and common curlew and formally ringed plover, which now prefers gravel pits or arable fields. All are Biodiversity Action Plan - listed species with stone curlew on the short list of species of globally threatened/declining status.

Breckland's flora is particularly distinctive for its "steppe" element, species which range on the continent from Scandinavia to the Mediterranean, east to Russia and Siberia. Many require soil disturbance to maintain their populations. Breckland's heaths are home to 19



Berner's Heath, Icklingham	Lakenheath Warren
Bridgham & Brettenham Heaths	Maidscross Hill, Lakenheath
Cavenham/Icklingham Heaths	RAF Lakenheath
Cranwich Camp	Stanford Training Area
Deadman's Grave, Icklingham	Thetford Golf Course and Marsh
East Wretham Heath	Thetford Heath
Field Barn Heaths, Hilborough	Wangford Warren and Carr
Foxhole Heath, Eriswell	Weather and Horn Heath, Eriswell
Gooderstone Warren	Weeting Heath

Breckland is a proposed Special Protection Area under the EC Wild Birds Directive for its populations of stone curlew (65%), woodlark (c40%) and nightjar (10%) (%of UK populations for each species).

**The resource**

	Number with Significant heath	Area
Nationally important sites (SSSIs)	27	~ 6,300 ha
Sites with natural area importance (County Wildlife Sites)	56	~ 400 ha
Thetford Forest Park heaths and rides	-	~ 300 ha

**Key species and species groups**

**Vascular plants**

	RDB	Nationally Scarce	Total	BAP-Listed	Breckland Specialities
Heathland/grass heath	10	9	19	11/19	11/19

RDB spp = Blue fescue (*Festuca longifolia*), Lizard orchid (*Himantoglossum hircinum*), Spotted cat's ear (*Hypochaeris maculata*), Early spider orchid (*Ophrys sphegodes*), Purple-stem cat's tail (*Phleum phleoides*), Spanish catchfly (*Silene otites*), Breckland thyme (*Thymus serpyllum*), Spiked speedwell (*Veronica spicata*) and spring-speedwell (*Veronica verna*).

**Invertebrates:** the key groups are beetles, bees/wasps, flies, moths, spiders, grasshoppers and true bugs.

Over 80 RDB species are associated with heaths/grass heath including the following BAP-listed species *Harpalus froehlichii* (a ground beetle), *Pherbellia knutsoni* (a snail-killing fly), *Truncatellina cylindrica* (a snail), *Scopula rubiginata* (Tawny wave moth) *Heliothis viriplaca* (Marbled Clover) and *Tyta luctuosa* (Four-spotted).

The endangered species (RDB1 or pRDB1) are *Acinia corniculata* (a fly), *Copris lunaris* (a ground beetle), *Empis meleana* (a fly), *Empis prodromus* (a fly), *Emus hirtus* (a ground beetle), *Epitriptus arthriticus* (a fly), *Walckanaeria stylifrons* (a money spider), *Amara fusca* (a beetle), *Coleophora tricolor* (a moth), *Cymindis macularis* (a beetle) and *Lasioglossum sexnotatum* (a solitary bee).

Significant species include a group of coast dwellers, rare inland including the silver spiny digger wasp (*Oxybelus mandibularis*).

## Breckland issues and current factors

- The well being of the heaths depends on sustainable stock grazing by sheep and in places cattle. This is successfully supported at present by the Breckland ESA scheme which provides a vital incentive to fence and graze. Stock numbers and the grazing regime need to be tailored to the particular interests of the land, although a tight open sward is most frequently the ideal outcome. Livestock regimes, breeds and husbandry also need to be tailored to achieving the greatest wildlife benefits e.g. avoiding excessive supplementary feeding or erratic stocking on heaths. Supplementary feeding may raise the site nutrient levels. Extending grazing to some Common sites will require Secretary of State approval for fencing.
- Grass heaths remain vulnerable to being lost to agricultural intensification unless they are statutorily protected sites or entered into protective schemes such as the ESA. Significant competing landuses include vegetable production with spray irrigation and outdoor pig rearing. Farm reservoir construction, to secure water supplies, is a powerful economic disincentive to maintaining or expanding heathland.
- The past fragmentation of once extensive heathland threatens the reduced populations of typical heathland plants and animals. Attempting to recreate heathlands on arable and afforested land is a priority. The best outcomes are likely on land which was most recently heathland, close to existing heaths and where links can be made between remaining sites. Re-creation from forestry is likely to be easier than from arable land because the soil structure and fertility is less altered. As noted above the value of competing agricultural land-uses makes extensive re-creation generally economically unattractive to landowners. Agri-environment measures will need to address this if Breckland is to contribute, as it should, to government targets for heathland re-creation in the Biodiversity Action Plan.
- Maintaining rabbit grazing is vital to produce the very tight grazed open disturbed lichen and moss rich grass heaths that much Breckland wildlife requires. Myxomatosis remains an active suppressor of numbers. Rabbit viral haemorrhagic disease would have serious effects on Breckland's heathland quality if it becomes established in Britain.
- Atmospheric nitrogen levels in Breckland (from traffic, industrial and agricultural sources) are thought to exceed critical loads i.e. to be sufficient to detrimentally change the vegetation of heather heaths in the future. This fertilising effect requires further study. Agricultural fertilisers spread on arable land beside heaths can also change heather to rank grass at the margins.
- In managing existing heaths or undertaking re-creation on arable or forestry land there is a need to integrate the needs of the ecology, archaeology and geology. De-stumping of sites may be detrimental to archaeological remains and careless tree and scrub removal may also affect geological features.
- Much Breckland heathland is inaccessible and there is therefore a need to increase public awareness of the management needs of heathland and increase, where appropriate, community involvement in their management. This happens for example at Barnham Cross Common. Heathland is a relatively robust habitat but accessible sites can come under pressure from activities such as waste tipping, motor bikes, accidental fires and fouling from dogs. Some heathland species are susceptible to disturbance, most notably ground nesting birds. Monitoring the populations of important Breck species must be encouraged. Ground nesting birds such as stone curlew have been a particular focus of conservation effort. Monitoring of their populations is needed, allied to protection from land management

operations, controlling disturbance and understanding the value of predator control. Breckland plant specialities showed marked declines in the 1970s and 1980s. Monitoring should ensure that this is not repeated. Invertebrate species recording generally needs encouraging further.

- Skilled labour to undertake conservation management and/or to provide practical management advice will continue to be important.

## **Nature Conservation Objectives**

- Identify and achieve Biodiversity Action Plan Targets for heathland habitats and the species they support.
- Secure, without damage or loss, all existing areas of Breckland grass, lichen and heather heath.
- Maintain and improve the wildlife value of Breckland heathland through appropriate sustainable grazing management systems.
- Expand and link areas of Breckland heathland by re-establishment of this habitat on suitable sites to return to the 1945 total of 14,000 hectares of heathland.
- Maintain and strengthen populations of all nationally important species associated with Breckland heathland.
- Maintain and strengthen populations of key characteristic and locally rare species of Breckland heathland.
- Secure the future of heathland species through a considered programme of species introductions and re-introductions to re-establish their full ranges.

<b>Management, research and monitoring priorities</b>	MAFF	English Nature	Farmers/Landowners	Local Authorities	Local Communities	Conservation Organisations	English Heritage	Environment Agency
Develop the ESA and other schemes to further benefit priority wildlife features on heaths	●	●	●	●		●		
Identify livestock systems which produce better, sustainable grazing regimes	●	●	●			●		
Resist development proposals that result in loss or damage to heathland		●		●	●	●		
Research the effects of atmospheric pollution on Breckland heaths	●	●						●
Integrate the needs of geological, archaeological and biological interests in management	●	●	●	●		●	●	
Develop the ESA and other schemes to achieve reversion of arable and woodland to heath	●	●	●	●		●		
Develop partnerships to promote targeted heathland re-creation	●	●	●	●	●	●	●	
Develop a programme of sites/species suitable for approved re-introductions		●	●			●		
Implement local and national Biodiversity Action Plans relevant to Breckland heathland, including monitoring	●	●	●	●	●	●		
Act to prevent rabbit viral haemorrhagic disease becoming established	●		●					
Achieve public understanding of the value and needs of heathland	●	●	●	●	●	●	●	
Monitor and manage public access pressures on heathland to avoid harmful disturbance		●	●	●	●	●		

## 4. Groundwater fed wetlands

### Pingos, Meres and Spring-fed Mires

#### Description

Breckland is known, almost defined, by its heathlands and yet it also has many internationally and nationally important wetlands which rely on groundwater emerging from the chalk aquifers below.

#### Fluctuating Meres

There are twelve semi-permanent Meres in Breckland with a fluctuating water level, all in Norfolk. The best known are Ringmere and Langmere at East Wretham Heath, the first Nature Reserve in Breckland, the Devil's Punch Bowl and Fowlmere in STANTA. These unique hydro-geological features (see Geological Character chapter) are also biologically important systems fed by base-rich groundwater with no in-flow or out-flow streams. The direct connection with the aquifer leads to seasonal fluctuations in water levels in the Meres, low in mid winter and higher in the summer, reflecting a lag in recharge from winter rains. Longer climatic cycles lead to the Meres drying completely in some years as has happened up to seven times this century. In the dry years of 1859-1862 and 1900-1903 crops were grown in the beds of Langmere and Fowlmere!

Unlike almost all other inland freshwater bodies the Meres are naturally self-sustaining with no tendency to grow over with swamp, reedbed or woodlands. Instead the fluctuating water level constantly destroys established vegetation and creates bare mud for fresh colonisation by a number of rare and local plant species which require low competition and low nutrient levels.

In the flooded state the Meres are characterised by pondweeds and stoneworts. In the dry phase the vegetation occurs as concentric rings of different plant communities with two rare bryophytes (a moss and a liverwort) living on exposed bare mud. The invertebrate fauna also includes rare species and a highly characteristic group of species which can survive dry periods either by burrowing into damp soil or because they form a desiccated egg stage which awaits the re-wetting of the system. Two such species are known in Britain only from the Meres.

The bird life of the Meres is rich in wildfowl in the water-filled years, especially little grebe, tufted duck, gadwall, pochard, and the occasional shelduck.

A number of other water bodies are called meres in Breckland but these differ from fluctuating Meres in being rainwater fed. These meres, for example those in Wretham Park lie on lenses of clay and are not primarily groundwater fed nor show the marked rise and fall in water levels. As a consequence they lack the characteristic species of the fluctuating Meres. Meres were a focus of early human settlement and frequently have archaeological deposits around, and sometimes in them.

## **Pingos**

Three open pingo systems, extensive areas of pits and pools, survive in the natural area today, relicts of tundra-like conditions 20,000 years ago (see Geological Character chapter). These are at Thompson, Foulden and East Harling Commons. Similar systems occur at five or more other sites such as Hills and Holes (Great Hockham), Breckles Heath and Frost's Common which are now covered in plantations, making interpretation difficult. Pingos also occur extensively in the Stanford Training Area, some in open grassland but many obscured by a dense scrub woodland. Another fine system occurs at East Walton Common just outside Breckland.

Pingos at the three main sites in Breckland contain varying amounts of water. Some are over-grown, filled with willows and nearly dry, whilst others are permanently wet with open water and fen vegetation. Water supply from below varies from one pingo to the next. Open pingos with marked fluctuations in water level have low growing vegetation with mints, marsh pennywort, bogbean and carpets of mosses. Others have tall fen vegetation of reed, saw sedge, and tussock sedges. Water violet fills some of the pingos producing a floating pink flowered spectacle in May and June, whilst bladderwort, fen pondweed and amphibious bistort are other characteristic aquatic species. Damp areas are flower-rich too, and include the lovely marsh helleborine and other marsh orchids.

These features have a remarkable range of invertebrates, especially water beetles more typical of far northern latitudes, which may therefore be glacial relicts in a glacial relict landscape. These are "mini mammoths" alive and well in Breckland as long as their pools remain fed with nutrient poor water. These sites, Thompson Common especially, are vibrant with dragonflies and damselflies in summer. Pingos are excellent breeding sites for amphibians and are especially notable for their populations of great crested newts, toads and common frogs.

The raised rims between the pingos are often clothed in heath vegetation - acid grassland, gorse, birch, broom and heather itself. Where grazing has been absent for a long time this develops towards oak woodland. At Thompson, fine chalk grassland rich in plant species occurs between the pingos, kept open by pony grazing.

## **Spring Fed Mires**

In the headwaters and tributaries of the Little Ouse, Lark, Wissey and Thet are spring-fed wetlands, known as valley head fens or headwater fens, which depend on this nutrient-poor, chalky, water. The emerging springs or seepage lines percolate through thin peat layers making this alkaline too and virtually permanently wet under foot. The vegetation of the seepage slopes is characterised by black bog-rush and blunt-flowered rush with marsh marigolds, fen bedstraw and the late summer-flowering devil's-bit scabious, as seen at Great Cressingham Fen, Thompson Common and Gooderstone Fen in Norfolk and Weston Fen in Suffolk. Fen meadow vegetation is also typical with purple moor grass, blunt flowered rush and a host of flowering plant species whose "marsh" names indicate their love of a high water table - species such as marsh valerian, marsh pennywort, marsh lousewort and marsh orchids.

The aptly named hacksaw-leaved saw sedge forms extensive beds in Talent's Fen on Foulden Common and at Swangey Fen on the edge of the Natural Area. Saw sedge is a component of the tall fen vegetation in many valley-head fens, together with common reed and lesser pond sedge.

All these fen types are rich in insects, especially water beetles, snails and fly species. Reed and sedge warblers are typical breeding birds. Grass snakes can be fairly common too, doubtless feeding on the frog populations of the ditches and dykes. Sites like Weston Fen are home to large numbers of dragonflies and damselflies.

Little remains of the formerly extensive fens on the Breckland/Fenland boundary. Pashford Poors Fen and Lakenheath Poors Fen are two that have survived with their mosaics of species-rich fen meadow and wet grassland. Fen vegetation also occurs in the river valley floors, for example between Thetford and Brandon and undoubtedly receive some groundwater in places from the edge of the sands. However these fens are also strongly influenced by river water levels and are considered further in the River Valley Habitats chapter.

## **Influences past and present**

The two major post war influences on the wetlands of the Brecks are abandonment of traditional management and changes to the hydrology of these sites.

The spring-fed fens have been vulnerable to drainage of adjacent land for arable or better grazing, with subsequent drying out and scrub invasion, as has happened to fens on the Beachamwell Stream since 1950 and at Stoke Ferry Fen. Traditionally fens were grazed and/or cut for reed, saw sedge and peat fuel. Abandonment of these traditional practices this century has led to willow and alder scrub invasion and a loss of wildlife value. Even the Meres have become more enclosed in recent decades - evidenced by the great die back of young birch trees following the exceptionally high groundwater levels of 1988/89.

The Poors Fens on the fenland edge are fragments of formally extensive fen and ill drained grassland reclaimed up to the last war. Some 99.7% of Fenland has been lost. The transformation of over 3,000 acres of land subject to winter flooding into productive agricultural land by 1949 is well recorded. Post 1950s agricultural reclamation of many areas on the fen edge has also occurred associated with the Great Ouse Flood Protection Scheme. The remaining sites are detrimentally affected by adjacent drainage and vulnerable to groundwater abstraction.

The pingo sites have similarly suffered scrubbing up, shading and organic mud accumulation from leaf litter as a result of post war lack of grazing. Aerial photographs of Foulden Common in 1946 show it almost free of scrub, most of the northern half is now birch/oak woodland with willow scrub in many pingos. Thompson and Foulden commons are grazed again but require much restorative work to rescue their open condition and full wildlife value.

Some shallow pingos have been ploughed out in the past and several systems remain hidden beneath coniferised forest plantations.

All the above wetlands are vulnerable to groundwater abstraction for public water supply and especially agricultural spray irrigation which has become widespread since the 1970s.

Irrigation gives great flexibility of cropping and makes Breckland's light soils ideal for vegetable growing (see Arable Farmland Habitats Chapter). Aquifer abstraction places wetlands under greatest stress in years when dry conditions naturally effect them most severely. Abstraction exacerbates the length of naturally dry conditions in the fluctuating meres and is of no ecological value to these systems.

Groundwater will be of especial importance to the survival of wetlands if predictions about climate change prove accurate.

## **Evaluation of the Wildlife Resource**

Breckland's wetlands are of high nature conservation importance, a fact emphasised by about a quarter of all SSSIs in the Natural Area being dominated by these habitats.

Four sites are of international importance. Three, Foulde Common, Great Cressingham Fen and Thompson Common are within the Norfolk Valley Fens candidate Special Area of Conservation for their calcium rich spring fed vegetation. Thompson is also listed for the presence of the tiny Desmoulin's snail. Weston Fen is part of the Waveney and Little Ouse Valley Fens candidate Special Area of Conservation for its purple moor-grass meadow community. It too has a EC Habitats and Species Directive-listed snail present, the narrow mouthed whorl snail, as well as Desmoulin's snail.

The pingo sites have an outstanding group of rare water beetles recorded, the largest number, 15 nationally rare species, being at Thompson Common. Weston Fen is also important for its water beetles, whilst Pashford Pools Fen is the only UK site for the leaf beetle *Cryptocephalus exiguus*.

Around 60 Red Data Book (RDB) invertebrates, including prominently, water beetles, moths, and snail-killing flies are found in Breckland wetlands. At Thompson Common alone 46 RDB and 318 nationally notable or local species have been recorded for all habitats on this site. Of the 60 wetland RDB's 12 are on the Biodiversity Action Plan (BAP) list as species of international conservation concern - the largest group, 5 species, being snails.

By contrast to the wealth of nationally rare plants of heaths and disturbed ground only two species are found in Breck wetlands. These are narrow small-reed found at Cranberry Rough, and slender cottongrass recorded from Thompson Common. However several nationally scarce species are found in wetlands, four of them again at Cranberry Rough - cowbane, marsh fern, milk parsley and fibrous tussock-sedge.

Other notable records include the pool frog at Thompson Common which has used pingo pools to breed. The species is feared recently extinct here. It is debated whether this is possibly its sole native British site. The search continues for this BAP-listed amphibian. The scarce emerald damselfly is another BAP-listed species known from pools in Breckland. Fluctuating meres hold several nationally rare species including a water flea found only in the meres in Britain and the moss *Physcomitrium eurystomum* found in four meres.

Table 2 gives more facts and figures on Breckland wetlands.

**Table 2 - Facts and Figures**

**International Importance**

Three nationally designated sites in Breckland, Foulden Common, Great Cressingham Fen and Thompson Common form part of the Norfolk Valley Fens candidate Special Area of Conservation (cSAC) under the EC Habitats and Species Directive for the following features:

- Calcium-rich spring water fed fens, which Norfolk is one of the best areas in the UK.
- The presence of Desmoulin’s snail (*Vertigo moulinsiana*) at Thompson Common.

Weston Fen is part of the Waveney and Little Ouse Valley Fens cSAC for:

- Purple moor grass meadows.
- Presence of Desmoulin’s snail and the narrow-mouthed whorl snail (*Vertigo angustior*).

The fluctuating meres at East Wretham Heath and the Stanford Training Area form part of the Breckland cSAC for:

- Naturally nutrient rich lakes or lochs dominated by pondweed vegetation.

**The resource**

	<b>Number with significant groundwater fed habitat</b>	<b>Area</b>
Nationally important sites (SSSIs)	12	110 ha
Sites of natural area importance (County Wildlife Sites)	no reliable data	

**Key Species and species groups**

**Vascular plants**

	<b>RDB</b>	<b>Nationally</b>	<b>Total Scarce</b>	<b>BAP-Listed</b>	<b>Breckland Specialities</b>
Spring-fed wetlands	2	9	11	2/11	0

The two nationally rare species are narrow small-reed (*Calamagrostis stricta*) and slender cottongrass (*Eriophyllum gracile*): the latter has no recent records.

**Invertebrates:** the key groups are water beetles, flies, snails, true bugs, spiders, damselflies/dragonflies, microcrustaceans.

Around 60 RDB invertebrates are associated with Breckland wetlands including the following BAP-listed species: *Agabus striolatus* (a water beetle), *Bidessus unistriatus\** (a water beetle), *Badister peltatus* (a ground beetle), *Lestes dryas* (the scarce emerald damselfly), *Microdon devius* (a hoverfly), *Odontomyia angulata\** (a soldier fly), *Perizoma sagitta* (marsh carpet), *Archanara algae* (rush wainscot moth), and the snails, *Anisus vorticulus*, *Hymnaea glabra*, *Segmentina nitida\**, *Vertigo angustior\** and *Vertigo moulinsiana*, together with *Clubonia rosserae* (a spider) and *Cryptocephalus exiguus\** (a leaf beetle).

The endangered species RDB1 or pRDB1 are those marked \* and *Bagous lutosus* (a weevil).

The water flea *Dunhevidia crassa* is known in Britain only from the fluctuating Breckland meres.

**Amphibians**

Breckland wetlands support 6 Biodiversity Action Plan - listed species: Toad, frog, great-crested newt, palmate newt, smooth newt and the pool frog which may be recently extinct at Thompson Common, possibly its only native British site.

## Issues and current factors

The groundwater-fed wetland resource of Breckland is undoubtedly depleted from its past extent, principally through drainage and agricultural intensification but also from afforestation and changes in land use and wetland management. This loss is patchily documented. Current key factors include

- Groundwater abstraction for public water supply, crop irrigation and vegetable washing poses the greatest long-term threat to the maintenance of Breckland wetlands. High summer demands correspond with spring fed sites being under the greatest physical water stress. Demand is set to rise, because flexible cropping patterns are possible with irrigation water and since the 1970s the area has become an economically important vegetable producing region. However, in some catchments water resources are assessed to be fully committed and any further development will have to come from winter storage.
- The Great Ouse Groundwater Scheme of the 1970s installed the infrastructure to supply public demands for water in Essex (and now Cambridge) and support river flows. The pattern of operation of this network strongly influences potential impacts on wetlands of nature conservation importance.
- Current legislation focuses on the protection of SSSIs, but not other sites of wetland conservation value. Present policy and practice seeks to balance competing needs for water. This does not give primacy of need to irreplaceable wetland communities.
- Precise information on the water supply requirements and hydrological regimes of wetlands is frequently not known or insubstantial. Improved hydrological and ecological monitoring is taking place on a few key wetlands but it is recognised that this will provide only partial insights.
- Groundwater quality may fall in catchments supplying wetlands due to fertilisers/pesticide applications to farmland. There is no evidence that this is presently a substantial problem.
- Past drainage schemes have lowered water levels in or beside wetlands reducing their wildlife value. In many places this trend needs to be reversed through control of water levels around sites and reversion of arable land to wet grassland or tall fen vegetation.
- Providing adequate levels of management to maintain wetland wildlife has proved difficult. Inadequate stocking, the loss of traditional markets for wetland products e.g. mowing litter, saw sedge and reeds has led to abandonment and scrub invasion of open wetlands. Pingo sites also suffer infilling with organic debris when scrubbed up or overhung by encroaching woodland.
- Restoration of wetland sites is needed to maximise their wildlife value, for example, the removal of scrub or coniferous plantations from pingo sites or the return of higher water tables in some cases by reversal of drainage schemes.

## Nature Conservation Objectives

- Achieve groundwater flows at levels required for the long-term hydrological sustainability of all ecologically significant wetland sites.

- Ensure the maintenance of groundwater quality supplying all ecologically significant wetlands.
- Secure the means to achieve appropriate practical management of wetland sites and the restoration of degraded sites to maximise their wildlife value, geological and archaeological interest.
- Identify and achieve Biodiversity Action Plan targets for Breckland wetland habitats and the species they support.
- Maintain and strengthen populations of all nationally important species associated with Breckland wetlands.
- Maintain and strengthen populations of key characteristic and locally rare species of Breckland wetlands.
- Review current legislation to ensure the framework exists to protect all ecologically significant wetlands.
- Secure the future of wetland species through a considered programme of species introductions and re-introductions to re-establish their full ranges.

<b>Management, research and monitoring priorities</b>	Environment Agency	MAFF	English Nature	Landowners/Farmers	Local Authorities	Local Communities	Conservation Organisations	IDBs	Dept of the Environment	English Heritage
Develop a strategy to ensure water-use provides for the needs of all ecologically significant wetlands based on consultation, research, monitoring and licence review	●	●	●	●	●	●				
Develop further an understanding of the hydrology and ecology of wetland sites to judge needs and impacts	●		●	●			●	●		
Develop farming systems in Breckland which require less water	●	●	●	●						
Encourage winter storage, as an alternative to groundwater, where this causes no adverse impact on wildlife sites or river flow regimes	●	●	●	●	●		●	●		
Monitor groundwater quality, especially in the catchment of important wetlands	●									
Implement the land management needs of wetlands to protect and enhance their biological, geological and archaeological interests.		●	●	●	●		●	●		●
Develop the ESA and other schemes to further benefit priority wildlife features on wetlands	●	●	●	●	●		●			
Restore the hydrology of wetlands affected by past drainage e.g. through Water Level Management Plans	●	●	●	●	●		●	●		
Develop the ESA and other schemes to incorporate wetland re-creation incentives	●	●	●	●			●			
Achieve the restoration of open pingo systems on afforested land		●	●	●	●		●			
Implement local and national Biodiversity Action Plans relevant to Breckland wetlands including monitoring	●	●	●	●	●	●	●			
Develop a programme of key species monitoring to identify populations for enhancement work	●		●				●		●	
Investigate legislative constraints hindering better protection of Breckland's wetlands	●		●				●			
Develop a programme of sites/species suitable for approved re-introductions			●	●			●			

## 5. Farmland habitats

### Description

Arable farmland forms a major landscape element of Breckland, comprising about 60% of the total natural area. This chapter describes the wildlife of this farmland; the arable fields and their headlands, tracks and waysides, boundary hedges and tree belts and other important features such as ponds. Together, these strongly man-influenced features can still support an important wildlife resource dependent on suitable management continuing amidst the pattern of farming practice. Breckland is an intensively farmed landscape with wildlife often kept to the margins.

The main arable crops are winter cereals, barley, wheat and occasionally some rye together with sugar-beet, linseed and vegetables. Potatoes, carrots and salad crops thrive on irrigated sandy Breckland soils fertilised with organic residues including poultry manure from the many units in the Brecks. Sheep grazed grass leys may be included in the vegetable growing rotation and sheep are also used to graze on vegetable tops in winter. Rotations also characteristically include the rearing of pigs outdoors, their arcs are a characteristic feature of modern Breckland. Another characteristic feature is the extensive use of polythene to promote early cropping. As a result some fields look like large inland water bodies in some lights.

Unsprayed Breckland arable field margins are home to a range of rare plants and characteristic species such as flixweed, sand catchfly, venus looking glass, fine-leaved fumitory and the ubiquitous poppy. Intensively cropped arable land is generally low in wildlife interest, however ground-nesting birds including lapwing, occasional ringed plover and oystercatcher make use of spring-sown land. As, of course, does half the stone curlew population. In winter arable fields host flocks of lapwing and golden plover and small numbers of woodlark.

Tracks, waysides and disturbed ground are rich habitats for Breckland wildlife. They represent fragments of the previously extensive, periodically cultivated or rabbit-worked ground to which Breckland's wildlife has been long adapted. They are remnants too of the once less tidy and intermittently cultivated landscape that was the basis of the shooting estates of the 19th century and earlier. There are more Breckland rare plants associated with these arable and "ruderal" habitats than the heaths themselves, highlighting their need for open sparse vegetation free from competition. National rarities include perennial knawel, spring speedwell and grape hyacinth. Aside from the special, the vibrant blue-flowered viper's bugloss is a typical species of such situations as is the striking houndstongue. Waysides are rich in insects, including several rare moths, whilst compacted sandy situations are important for solitary wasp species and banks hold important populations of beetles including nationally rare species. These fragments of grassland are favoured by skylarks, grey partridges and other farmland birds. Hares are another typical species, frequently seen.

Pine lines and belts, often with grassy margins are especially characteristic of Breckland. They enclose an older arable landscape and date from the enclosures of the late 18th and 19th centuries. Some were set on earthwork banks. Contorted multi-stemmed pines are the result

of overgrown pine hedges being allowed to grow out for 100 years or so. Elsewhere, beech hedges and belts are also characteristic as are hawthorn hedges. These boundary features are feeding territory for hawfinches and crossbills whilst hobby nest in the thicker pine belts. Scrubbed up grassy areas are breeding habitat for tree sparrows, linnets, and other farmland birds in general national decline.

A few rare invertebrates are associated with older pines but these trees and their insects are not well studied.

Ponds in Breckland include not only the farm and village examples but also marl pits in arable land. Marling involved spreading chalky clay subsoils onto acid sandy fields to improve their fertility. Many pits are seasonally wet and form breeding habitat for amphibians, wherever invasive shading scrub is not too dense. Important populations of great crested newts are found in such situations.

## **Influences Past and Present**

The land-use history of Breckland and its impact on wildlife is described by several authors and well summarised by Peter Lambley (1994) (see bibliography). Simplistically, the arable, heath, Brecks and warrens of the late medieval period with their extensive disturbed ground and open sparse turf experienced fluctuating prosperity in succeeding centuries and by the 19th century had become, in many places, patchily cultivated large shooting estates. These in turn saw progressive agricultural improvements for the 1920s onwards on land not planted with pines. The Elveden Estate was in the forefront of this revolution in farming practice and grew to be, today, about 7% of the natural area - the largest arable farm in England.

Post war change has been especially rapid. Arable farmland has expanded at the expense of heathland and rough grazing. Increased application of inorganic fertilisers, selective agri-chemicals and improved seed varieties has increased yields but more intensive cultivation has significantly reduced ruderal or uncultivated margins, tracksides and fallow fields. Rabbits have been less tolerated in this landscape as they pose greater threats to valuable crops.

Heavy investment in spray irrigation since the 1970s has removed water as the main constraint on arable cropping. This, together with herbicide and pesticide application, in effect transforms grade 3/4 agricultural land into the production more usually associated with grade 1 land. Farming practice in Breckland, as elsewhere, responds to and reflects the consequences of national and European policies and economics.

Development pressures have also threatened these ruderal sites, for example, a formally large colony of field southernwood in Brandon has been reduced to a remnant by an industrial estate and a site formerly important for insects is now a cafe at Barton Mills.

The net effect of agricultural intensification has been a reduction in the special Breckland arable/ruderal flora, and the loss of populations dependant on disturbance, either through lack of management of sites or loss of rabbits, or both. Spring-sown arable crops attract heathland and nesting bird species (especially in years when the heaths are in poor condition) notably

stone curlew and ringed plover. In common with many areas of lowland England, Breckland has probably seen a sharp decline in farmland birds such as tree sparrow and skylark because of a lack of weedy overwintering stubbles for seed eating species and corresponding declines in summer food supplies. Well documented declines of invertebrate species include moths dependent on plants of disturbed ground such as the grey carpet and marbled clover.

A relatively recent welcome change has been the introduction of the arable headland prescriptions in the Breckland ESA Scheme, which benefits both rare arable flowering plants and also many invertebrate populations. Also in recent years set aside has re-created temporary fallow in Breckland, although the majority is routinely sprayed-off before it develops a significant wildlife value. Some set aside has been manipulated by sympathetic landowners to benefit farmland birds including stone curlews and has probably assisted skylark populations. Several thousand hectares have been in set aside in any given recent year although this modern fallowing is set to disappear under current trends.

## **Evaluation of the Resource**

Breckland has a highly characteristic flora which relies on ruderal habitats or unsprayed arable field margins on chalk. More nationally rare species are found in these conditions than on heaths. Rare arable weeds such as ground pine and small alison rely on chalky field margins as do the Breckland specialities such as fingered speedwell and early speedwell.

There are seven nationally important arable, trackside or wayside sites, mostly in Suffolk, identified for their rare plant species interest, amongst other features (see table xyz). These include an arable weed reserve beside Weeting Heath National Nature Reserve, which has six nationally rare and three nationally scarce species present. Outstanding Suffolk locations include the Cherry Hill site near Barton Mills and the former gravel pit workings at Maids Cross Hill. However, rare plant species populations are often small and frequently found on the non-statutorily protected County Wildlife Sites. These have a degree of protection through local authority development Plans, but not from wider land-use changes.

Consistently, over half of Breckland's stone curlew population nest on arable fields, in spring-sown crops, reflecting a lack of appropriate habitat associated with the heaths. This represents more than a quarter of the total UK population. Breeding success on arable is lower than on the heaths, for a variety of reasons, and requires the active co-operation of landowners and conservation bodies who intervene to ensure arable nesters successfully fledge young.

At least a dozen nationally rare invertebrates dwell in these habitats including species such as the leaf beetles *Psylloides sophiae* which occurs only in Breckland, feeding on flixweed. Four species are included in the Biodiversity Action Plan list of globally threatened/declining species (see table).

**Table 3 - Arable Farmland Habitats - Facts and Figures**

<b>International importance</b>					
In the absence of sufficient suitable heathland habitat spring-sown arable supports over 50% of the nesting stone curlews of Breckland - one of three species for which Breckland is a proposed Special Protection Area under the EC Wild Birds Directive.					
<b>Key species and species groups</b>					
<b>Vascular plants</b>					
	<b>RDB</b>	<b>Nationally Scarce</b>	<b>Total</b>	<b>BAP-Listed</b>	<b>Breckland Specialities</b>
Arable/Wayside/Disturbed ground	10	10	20	8/21	13/21
The RDB species are Small alison ( <i>Alyssum alyssoides</i> )*, Field southernwood ( <i>Artemisia campestris subsp. campestris</i> )*, Drooping brome ( <i>Bromus tectorum</i> ), Glabrous rupturewort ( <i>Herniaria glabra</i> )*, Grape hyacinth ( <i>Muscari atlanticum</i> ), Perennial knawel ( <i>Scleranthus perennis subsp. prostratus</i> )*, Sand catchfly ( <i>Silene conica</i> ), Early speedwell ( <i>Veronica praecox</i> ), Fingered speedwell ( <i>Veronica triphyllos</i> )* and Spring speedwell ( <i>Veronica verna</i> ). Those marked * are BAP-listed as are Narrow-fruited corn salad ( <i>Valerianella dentata</i> ), Ground pine ( <i>Ajuga chamaepitys</i> ) and Red Hemp Nettle ( <i>Galeopsis angustifolia</i> ).					
<b>Invertebrates:</b> the key groups are moths, beetles, bees/wasps.					
Around a dozen RDB invertebrates are associated with arable/wayside habitats. This excludes some species more typically associated with the open disturbed habitats on grass-heaths. The BAP-listed species are the moths Marbled Clover ( <i>Heliothis viriplaca</i> ), Grey Carpet ( <i>Lithostege griseata</i> ) and the Four-spotted ( <i>Tyta luctuosa</i> ). To these can be added the endangered (RDB1) moth, Spotted Sulphur ( <i>Emmelia trabealis</i> ).					
<b>Birds</b>					
Breckland arable farmland holds important breeding and/or wintering populations of skylark, tree sparrow, corn bunting, woodlark, grey partridge, turtle dove and stone curlew (all are BAP-listed).					
<b>Mammals</b>					
Breckland is a major stronghold for the European brown hare ( <i>Lepus europaeus</i> ), a BAP short list species.					

## Issues and Current Factors

- The growth of spray irrigation and other inputs since the 1970s has enabled the intensive use for vegetable cropping of otherwise inherently poor sandy arable soils.
- The use of pesticides and herbicides has reduced arable weed floras, invertebrate populations for farmland birds such as grey partridge and weedy stubbles which carry a range of farmland birds through the winter.
- The Breckland ESA has provided welcome arable margin prescriptions to reverse some of these losses, but does not address the intensive inputs to the whole field.
- Fertiliser application (and wind-blown dressings) can lead to nutrient enrichment of adjacent wildlife habitats with attendant species loss. Eutrophication of watercourses can be a problem with raised nitrate flows in some rivers in winter.
- Periodic disturbance and abandonment of land is rarer under modern cropping systems and rabbits which created disturbed ground are less tolerated in a tidier countryside than formerly. Rabbit numbers are thought not to have recovered to pre-myxomatosis levels.
- The recent “fallowing” practice of set-aside is in decline and the management of the majority of this new habitat did not maximise its wildlife value because of agriculturally optimum cultivation and herbicide practices.
- There is a pressing need to revert suitable arable land to habitats of greater wildlife value, for example heathland, valley grassland, and wet grassland beside existing wetland sites, depending on the location of the arable.
- Outdoor pig rearing also poses threats to the quality of surface waters. An agricultural benefit is that they enrich thin soils greatly, although this militates against any short term prospect of reversion to heathland or less intensive cultivation. Pig and poultry manure is however a preferred feeding habitat for stone curlews.
- Ponds are no longer agriculturally useful for stock watering or marling and are therefore often infilled, encroached by willow scrub and dry, or severely affected by eutrophication from surrounding arable land.
- Important populations of characteristic Breckland species often occur in open farmland, off statutorily protected sites; declines in the Breckland flora are especially well documented.
- Boundary features such as pine lines and hedges, banks and belts are vulnerable to loss from dereliction and subsequent removal. This threatens much wildlife as these features, although not apparently comprehensively studied in Breckland, are likely to be significant for many species in the wider countryside.
- In common with other lowland areas where arable farming forms a major land-use there is a need for practical, integrated, whole-farm conservation advice to protect and expand the remaining wildlife value of farmland.

## **Nature Conservation Objectives**

- Develop reduced-input farming systems in Breckland which maintain the biological diversity of arable farmland habitats and expand key species populations and their distributions.
- Seek resources to achieve diversification of arable farmland to re-create and restore habitats of wildlife importance.
- Ensure practical advice is developed and delivered within the agricultural community to achieve wildlife benefits.
- Identify and achieve Biodiversity Action Plan targets for Breckland arable farmland habitats and the species they support.
- Ensure that populations of nationally important plants and animals of arable farmland are adequately protected and strengthened.
- Ensure that populations of key characteristic and locally rare species of arable are maintained and strengthened.

<b>Management, research and monitoring priorities</b>	MAFF	English Nature	Farmers/Landowners	Local Authorities	Local Communities	Conservation Organisations
Develop with the farming community practical farming systems which increase the wildlife value of arable through reduced pesticide and fertiliser use and more beneficial cropping patterns.	●	●	●	●		●
Develop systems of farming which maintain disturbed, ruderal, headland and wayside habitats in Breckland.	●	●	●			●
Develop the ESA and other schemes to achieve the re-creation and restoration of wildlife habitat from arable.	●	●	●	●		●
Develop agri-environment measures which increase the diversity of farmland habitats.	●	●	●	●		●
Achieve the re-habilitation and re-creation of ponds, pine lines and other features of wildlife value in the farmed landscape.	●	●	●	●		●
Implement local and national Biodiversity Action Plans relevant to Breckland farmland including monitoring.	●	●	●	●	●	●
Develop mechanisms to protect populations of nationally important plants and animals on farmland.		●	●	●	●	●
Identify and implement a programme of species introductions and re-introductions.		●	●			●
Increase understanding of the needs of species of ruderal and arable farmland.		●				●
Expand the delivery of conservation advice to achieve integrated, whole farm gains for wildlife.		●		●		●

## 6. Woodlands

### Description

Man progressively cleared the light native woodlands of Breckland from around 4000 BC onwards. From the Iron Age Breckland had virtually no woodland until the late 18th century when landowners created plantations for game and shelter belts to reduce wind erosion of arable land. The planting and management of Thetford Forest in the space of one present lifetime has transformed the landscape and created new habitats. This chapter briefly considers the ancient woodland of the natural area and the vastly greater Thetford Forest itself.

Other broadleaved woodland in “belts”, “spinneys”, “copses” and “plantations” testify to their man-made origin. The woody species include typically beech, sycamore, ash and the dominant oak. Game-cover shrubs frequently include mahonia, box, and snowberry. They are not of significant wildlife value and are not considered further. Fen carr woodlands are treated in the River Valley Habitats Chapter. Natural regeneration of woodland on heaths and commons has been a widespread 20th century phenomenon, dealt with elsewhere in this profile.

Ancient woodland, that is woodland that has been present since at least 1600 AD and is therefore presumed to be unplanted is very scarce in Breckland. A scatter of such woods occur on the southern edge of the natural area in Suffolk where the soils become heavier. Less than 200 hectares, much less than 1% of the natural area is ancient woodland, of which by far the largest, 108 hectares, is the Fakenham Wood/Sapiston Great Grove complex near Euston. The variety of soil types is reflected in the trees with oak, birch and hazel dominating on acid sandy Breckland soils and ash, field maple, wild cherry and hornbeam found on wetter or clay soils. Primroses, wood anemone, violets and early purple orchids are typical of this type of woodland. Fakenham Wood also has one of the strongest colonies of white admiral butterfly in Suffolk. Veteran trees are occasionally found in park landscapes or ‘wood pasture’ such as at Oak Pin, Risby and at Shadwell.

By contrast to ancient woods the pine and broadleaf woodlands of Thetford Forest cover nearly 20% of the natural area. The main forest blocks stretch from West Stow in the south to Swaffham in the north and from Mildenhall in the west to Harling in the East. They were established from 1922 onwards on land formerly heathland, old warrens and poor agricultural ground to become the major lowland pine forest in Britain. Afforestation clothed in trees the earlier man-made landscapes and their wildlife habitats, but also undoubtedly protected from agricultural intensification fragments of that past. The greatest wildlife value of Thetford Forest lies in the open spaces it protects or creates.

The full range of Breck calcareous to acid heathland vegetation occurs in the forest including 25 hectares in nationally important sites and 298 hectares in other blocks and rides of significant wildlife value. Typically chalky swards hold purple milk vetch, quaking grass and purging flax whilst the most acid are rich in lichens and heather with sand sedge on windblown deep sand areas. Breckland thyme and the purple stem cat’s tail grass are amongst the Breckland plant specialities which survive. Chalky grass-heath areas on rides are vital for the Breck moth specialities especially tawny wave moth, grey carpet and marbled clover moth as well as a host of localised and uncommon moth species. Sparsely vegetated

open ground is also rich in ground beetles and the site at Santon Street has recorded over 40% of the British fauna of sand wasp species.

Disturbed or bare ground is the key to the survival of much of Breckland's specialist wildlife. Rides and waysides provide this habitat to the benefit of plant specialities such as smooth rupturewort, wall bed-straw and sand catchfly.

Thetford Forest is one of only two strongholds for the military orchid in Britain, which occurs in a long dis-used chalk pit at the Rex Graham Reserve within the forest.

Nationally important wetland sites cover around 60 hectares in the forest including Horse Meadows and Cranberry Rough. Other important sites are afforested pingo systems at Frost's Common, Hills and Holes, and at Didlington. Hills and Holes and Frost's Common have records of scarce emerald damselfly. Knight's Fen is another important wetland, partially planted with poplars, as are the flood plain fens of the Little Ouse valley.

The breeding bird specialities of Thetford Forest are undoubtedly the woodlark and the nightjar. Both make use of the open ground created by extensive clear felling of tree crops. Both species favour the more acid sandy soils. Woodlarks however require bare ground or very short grass inter-mingled with areas of longer grass, bracken or heather and nest in areas of up to five year old re-stocks. Nightjars by contrast tolerate taller re-growth and nest in bare areas within pine crops up to 10 or more years old. Woodlarks feed within their clearfell territories whilst nightjars may also forage for moths extensively over any adjacent heathland.

Well surveyed species groups in the forest include amphibians and reptiles. Thetford Forest pools and fire ponds are especially abundant in toads but not frogs, presumably because of the general lack of wetland habitat. Smooth newts and great crested newts also occur as do grass snakes, adders and common lizards, but rarely slow worms. Wood mice, field and bank voles occur at low densities in the conifer plantations. Hares too occur in good numbers in the Forest. Five bat species occur, namely pipistrelle, long eared, noctule, Leisler's and serotine. Two important hibernacula occur and bat boxes have been installed in the forest for summer use by bats.

Some species have directly benefited from the creation of the pine woodland habitat. Most notable is the red squirrel, a species better suited to conifers than the alien grey. Thetford forest provides one of few lowland refuges. The red squirrel population is very low and its present reduction directly linked to the appearance of grey squirrels, which colonised the Forest as recently as 1968. A recovery programme is underway to secure the Breckland population, through maintaining suitable pine habitat, removing large seeded broadleaved trees which favour greys, controlling the local grey squirrel population and providing the reds with supplementary food.

Bird species which make use of the pines include goshawk which breed in the forest, as does the secretive hobby, also the pine kernal-eating crossbill and a large population of siskins.

Speckled wood butterflies have spread within the forest and beyond since they became well established in the 1960s. Other beneficiaries include white-letter hairstreak butterfly on elm understorey and white admiral reliant on honeysuckle.

Four deer species breed within the forest, all have arisen from deliberate introductions or accidental escapes in the area during the last 100 years. Their history makes fascinating reading (see FC 1996) especially the origin of the red deer as escaped “carted” animals, brought from parkland captivity to be released for hunting and recapture, live, for another days sport. Some 130 red deer regularly winter in the forest and reach exceptional size.

## **Influences Past and Present**

The Forestry Commission was set up in 1919 in a post war determination to reduce Britain’s reliance on imported timber. The depressed state of agriculture at the time led to more land being on offer to the Commission than they had funds to buy. Planting began in the spring of 1922. By 1934 some 10,000 hectares had been planted with a peak of over 1,400 hectares in 1927 alone. The bulk of the Forest had been planted by the late 1930s. The principal crop was scots pine although several other pines, larches and firs were tried experimentally by early foresters, as were broadleaves including oaks, birch, beech and sycamore. Some 12% of Thetford Forest is in fact broadleaf, planted for experimental, ornamental or fire-protection purposes. The veneer of hardwoods against many roads reflects past attempts to protect conifers from accidental fires. The maturing pines of the forest also act as a seed source from which pine scrub invades neighbouring heaths and other habitats.

Scots pines are today being replaced at replanting by the more productive and pest/disease tolerant Corsican pine. Eventually no more than 10% of the forest will be Scots pine. Clear felling runs at 350 to 400 hectares per annum and will fall slightly to a sustainable felling rate.

On chalky soils the risk of Fomes fungal rot requires the ground to be de-stumped and pushed up into windrows at clear felling creating temporary open ground for chalk flora and song posts for birds as well as cover for small mammals and rabbits. Since the 1960s management of replanted ground has involved chemical weeding and applications of insecticides as long as the crop warrants.

In 1990 Thetford was designated as a Forest Park, a reflection of the multi-use forestry objectives the Forestry Commission have for their land including amenity access. Over 1 million day visits are made each year to the Forest and increasing opportunity is made for sporting and recreational activities including cycle riding, walking, horse riding, orienteering, game shooting, observation of wildlife, the occasional car rally and even husky dog racing. Landscape considerations play a part in the present restructuring of the Forest through the production of Forest Design Plans. These are replacing the historic rectilinear compartments with more ‘organically’ shaped clearfells and replantings.

The design plans will shape the future structure and tree species composition of the Forest. Forestry activities are also regulated by the Thetford Forest Conservation Plan which sets out nature conservation objectives for sites, habitats and species of wildlife importance.

In addition, the Santon Valley is designated as a Forest Nature Reserve with its own specific management prescriptions.

The few ancient woodlands of the natural area were formerly coppiced for fuel wood. Many coppice stools have now grown out to form large multi-stemmed trees and a high woodland canopy. Coppicing has been re-instated in some of these woods in the last 15 years or so, for

example at Wayland Wood on the eastern margins of Breckland. This results in a diverse woodland structure favouring nesting birds, a greater range of insects and a flush of spring flowers after coppicing.

## **Evaluation of the Wildlife Resource**

The pine plantations of Thetford Forest are not, of themselves, of high nature conservation interest. The Forest Park does however enclose all or part of 9 nationally important sites for wildlife and geology covering some 88 hectares.

The flora of the Forest has included 12 nationally rare species and 13 nationally scarce of which 9 and 13 respectively still exist. Forest rides are especially important for smooth rupturewort where 13 of the 18 sites in Breckland are found. Forestry Commission land at Cranwich Camp is the only known site in Breckland for proliferous pink and one of only two nationally.

Breckland is internationally important for the presence of nightjar and woodlark which breed predominantly in Thetford Forest clearfells. Clearfells hold 9% of the UK breeding population of nightjars and a third of all Britain's breeding woodlarks. The Breck population of the latter has risen dramatically from 25 pairs in 1975 to over 300 in 1996, thanks probably to the available clearfell nesting habitat.

The red squirrel is the subject of a joint Forest Enterprise/English Nature Species Recovery Programme to keep this species viable in the Forest.

Unsurprisingly, given Breckland's long history without trees there are few nationally rare invertebrates species associated with woodlands. However, three nationally rare beetles do occur at Icklingham Plains and the pauper pug moth, a lime tree feeder, is found at STANTA and on well grown limes in Thetford Forest.

There are just two nationally important ancient semi natural woods in the Breckland Natural Area with another one on its eastern edge at Watton. The low percentage land cover which is ancient woodland places Breckland in the bottom 10 Natural Areas in England (out of 92). However, in Fakenham Great Wood it does have the only site in excess of 100 hectares in all East Anglia, although former royal forests such as Hatfield Forest cover a larger extent.

Table 4 gives more facts and figures on woodland in the natural area.

**Table 4 - Woodlands - Facts and Figures**

<p><b>The resource</b></p> <p>Total area of all woodland in Breckland - Thetford Forest = 21.0 k ha Other woodland = 8.8 k ha</p> <p>Total area of ancient woodland in Breckland = 282 ha Total area of ancient semi-natural woodland in Breckland = 188 ha</p> <p>% cover of ancient woodland = &lt;0.3%</p>
<p><b>Key species and species groups</b></p> <p>The open spaces in Thetford Forest protect fragments of Breckland habitats of value to typical species, whilst conifers are of more recent and lower value e.g. of 492 moth species recorded in the Forest Park only 13 use conifer forest exclusively, whilst 74 require heathland. Of the 459 beetle species recorded in Breckland around 40 are exclusively associated with conifers, of which only 1 species is nationally rare (RDB-listed). This contrasts with 28 RDB species which require open vegetation or heathland situations and 27 species which require wetland vegetation.</p> <p>The key BAP species found in Thetford Forest are woodlark and nightjar in clearfells, red squirrels in pine plantations and the plant, smooth rupturewort, which has its Breckland stronghold on open forest rides.</p>

## Issues and Current Factors

- Breckland has had a long history of treelessness. It is not appropriate to increase the area of coniferous or broad leaved woodland in the natural area where other land uses of greater wildlife value should be encouraged.
- The replacement of scots pine by Corsican in second rotation planting will have detrimental effects on the general wildlife value of the Forest by producing a smothering needle litter and a denser shade which will exclude plant and invertebrate species from compartments and narrow rides. The higher stocking rate and shorter cropping period will also prevent the development of a shrubby understorey which early heavy thinning of scots pine in places permitted.
- Restructuring of the Forest, through five yearly reviewed Forest Design Plans provides the opportunity to protect and expand wildlife habitats and the important species they support.
- Management of the open space habitats in the Forest will need to be practical and tailored to meet the needs of wildlife. Options to graze some of the Forest grass heaths, heathland and rides should be developed to complement the current cutting management. The creation of a heath/forest mosaic through the re-creation of grazed heathland is an important element. This will need to be designed sensitively for archaeological, landscape and access considerations.
- Thetford Forest Park will absorb increasing recreational pressures in the future, which should be managed to prevent harm to the natural environment.
- Pesticide use to establish trees should, where practical, be reduced. Any change of management practice in felling, clearing or establishing crops should be assessed for its environmental implications because of the potentially very large areas which may be affected in the natural area.
- Large clearfells favour key breeding bird species and should continue to be the cropping pattern.
- Present efforts to secure the red squirrel will be reviewed, lessons drawn, and hopefully a self sustaining red squirrel population established through this work.
- Management for rare plants in the forest should continue in order to secure the populations of all species.
- Much voluntary research and survey effort goes on within Thetford Forest into many species groups. This should be encouraged, supported and targeted at gaps in our knowledge of the habitats and species that form the Forest ecosystem.
- The appropriate management and marketing of ancient semi-natural woodland produce needs to continue.
- Re-establishing coppicing, where this is appropriate, must ensure that deer browsing of coppice stools is prevented.
- Nearly half the ancient semi natural woodland area has been converted to plantation woodland with conifers or inappropriate broadleaves.

## **Nature Conservation Objectives**

- Discourage new planting on unafforested land of both coniferous and broadleaved woodland where habitats of higher wildlife value exist or could be created.
- Encourage the conversion of appropriate wooded land to characteristic Breckland heath habitats.
- Encourage the removal of inappropriately planted trees on wetland sites such as pingo systems and floodplain fens to achieve restoration.
- Ensure that the Thetford Forest District management plans and procedures are implemented to fully benefit Breckland wildlife within the Forest.
- Ensure that no ancient woodland is planted inappropriately in future and encourage the removal of conifer or alien broadleaves from such sites to re-establish native tree communities.
- Achieve Biodiversity Action Plan targets for woodland habitats and the species they support.
- Ensure that populations of nationally important, key characteristic or locally rare plants and animals of native woodland are maintained and strengthened.

<b>Management, research and monitoring priorities</b>	Forest Enterprise	Forestry Authority	English Nature	Landowners/Farmers	MAFF	Local Authorities	Local Communities	Conservation Organisations	Research Bodies
Develop policies and strategies to divert new woodland planting away from the Breckland natural area		●	●		●	●		●	
Secure the resources to achieve reversion of substantial areas of appropriate wooded land to heathland	●		●	●	●	●	●	●	
Achieve public understanding and support for heathland re-creation from plantation woodland	●	●	●		●	●		●	
Review national and local policies to ensure heathland re-creation from woodland	●	●	●		●	●			
Develop knowledge to ensure practical re-creation of heathland from woodland		●	●		●			●	●
Develop plans to remove planted trees from wetlands of nature conservation importance	●	●	●	●		●		●	
Review periodically all Forest Plans and procedures to ensure that they achieve benefits for Breckland wildlife within the Forest	●	●	●	●		●		●	
Ensure recreational developments in Thetford Forest are implemented in an environmentally acceptable way	●	●	●				●	●	
Develop research and monitoring in the Forest to maintain and expand the wildlife resource	●		●				●	●	●
Implement local and national Biodiversity Action Plans relevant to afforested land	●	●	●	●	●	●	●	●	
Secure the resources to achieve sustainable management of ancient woodland sites		●	●	●	●			●	
Encourage the management of deer to protect coppicing in ancient woodland	●	●	●	●			●	●	

## 7. Rivers and their valley habitats

### Description

This chapter describes the river systems of Breckland together with the mosaics of valley habitats which still exist in places. Together, the rivers, wet grasslands, carr woodlands, flood plain fens, reedbeds and man made lakes are an important wildlife resource.

Three westward flowing rivers and their tributaries incise the low plateau of Breckland. The Little Ouse, Lark and Wissey with their tributaries comprise some 240 kilometres of river within the natural area. All are chalk rivers fed by groundwater, which can contribute up to 70% of total annual river flow. They drain an extensively arable upland catchment. The rivers and their major tributaries, the Thet, Sapiston/Black Bourne and Watton Brook, rise to the east of the natural area in the East Anglian Plains natural area. The three flow to the Ely-Ouse or, in times of flood, are diverted into the Cut Off Channel and then to the Tidal River via the Relief Channel, downstream of Denver. On average they contribute to the flow of the Ely-Ouse as follows; River Wissey 17%, River Little Ouse 36% and River Lark 12%.

River valleys were the focus for settlement from the earliest times onwards reflecting the obvious importance of water in a dry landscape. In common with most lowland rivers those in Breckland have been much modified by man for drainage and flood defence reasons or altered by diversions, or held by weirs/sluices and mills to produce water at required levels. River flows too are modified by support pumping from boreholes. A remarkable feature of the Norfolk rivers is their use to transfer groundwater, which can be pumped from a selection of river support boreholes in the Thet and Little Ouse sub catchments, to meet public water demands in Essex. In especially dry years this water supplements that which is diverted at Denver from the Ely/Ouse river into the Cut Off Channel to be subsequently pumped from the Cut Off Channel at Blackdyke through tunnels, pipelines and Essex watercourses to major reservoirs in south east Essex.

Water quality in these chalk rivers is typically good with beds of aquatic and emergent plants such as water crowfoots, pondweeds and reed and branched bur-reed abundant on gravelly substrates. Riffle-pool systems exist on most upstream sections, with the river Wissey being the finest example. Brown trout breeds on the Lark, Wissey, Thet and parts of the Sapiston. Angling for this species is a widespread activity on the Lark and Wissey supported by stocking and natural populations. Trout are absent from the Little Ouse which supports roach, dace, chubb and pike. The native white clawed crayfish has been recorded in Breckland rivers.

Riverside valley habitats are a rich mix of floodplain fens, wet grasslands, reedbeds, carr woodlands and some man made lakes which all add significantly to the diversity of Breckland wildlife. However in headwaters and the shallower valleys a lot of land has been converted to arable as in the Wissey and Lark valleys, coupled with canalisation and straightening leading to loss of bankside habitats too.

The fens are often abandoned pasture or mowing meadow characterised by tall vegetation of reed, reed sweet-grass or pond sedges and greater tussock-sedge, with nettle, willowherb and meadowsweet on drier ground. These fens have typically been planted with poplars, as seen extensively on the Little Ouse and Lark. The largest reedbeds, away from the spring-fed fens, occur in association with man made lakes such as Stanford Water, and also beside the Little Ouse at Horse Meadows. Sallow and alder carr has invaded many former fen sites, but a range of mixed ash/alder, willow/alder and pure alder carrs exist depending on landuse history and wetness. Several alder carrs have been coppiced for fuel over long periods. Typical plants include water mint, bugle, water avens, gipsywort and occasionally bogbean. All these carr woodlands are poorly described and will pay much further attention from naturalists.

Where land drainage is possible the cattle grazed valley grasslands have been agriculturally improved, reducing their wildlife interest. However, some retain a rich mix of sedges and rushes on peat, and flower freely with the pinks and purples of cuckoo flower, ragged robin and marsh orchids and the yellow of marsh marigolds and yellow rattle.

Additional habitat is provided by man made water bodies, either gravel pits or ornamental lakes attached to estate houses. These can be important breeding sites for waterfowl notably gadwall for which Breckland is the stronghold. Dragonflies and damselflies also breed well here - 15 species are known from Lackford Lakes, and the uncommon variable damselfly is known from Culford.

Otters are an important species on Breckland rivers, their natural populations having been supported by careful introduction programmes in recent years. Breeding is confirmed and this elusive animal makes good use of the carr woodlands for shelter. Water vole is another important species but there is little knowledge of its Breckland population trends which may mirror a national decline. Other typical species of rivers include dragonflies and damselflies such as the beautiful banded demoiselle. Breeding waterfowl include mallard, tufted duck and gadwall.

River valley grasslands provide hunting territories for barn owls and breeding sites for lapwings, some snipe and the occasional redshank. These sites are good hunting territories for bat species. All 10 species of East Anglian bats are known to occur in Breckland. Most British records of the rare Barbastelle in the last 10 years have come from Breckland and this may indicate a small but persistent population.

## **Influences Past and Present**

The early reclamation of floodplain fens would have followed the canalisation of rivers in the 17th century and the Fenland drainage schemes of the 17th and 18th centuries. Valleys would no longer have been inundated with silted flood water so frequently and the general lowering of water tables would have encouraged land drainage and conversion to grassland or arable production. Remaining areas of fen on the Lark, Thet and Little Ouse were progressively abandoned as their economic value for reed, peat, and mowing litter declined. Expansion of sallow scrub onto fen then followed, especially this century. River management works exacerbated this process. Several schemes up to the 1970s improved drainage but destroyed natural in-river features of wildlife value and further reduced the connection between the rivers and their flood plain habitats. The only true washland left today is on the Little Ouse below Lakenheath, an important site for wintering wildfowl, although periodic flooding still occurs, for example in the Wissey valley. The Environment Agency currently have a programme of small scale in-river restoration works underway to reinstate meanders or riffle pool systems where these have been lost by inappropriate past management.

River water quality should be high because of the large groundwater component. This remains largely true but there are 39 sewage treatment works discharging to streams in the natural area some of which prevent rivers meeting Environment Agency water quality targets on some lengths. Most effluents from industrial processes are discharged to sewage works but notable discharges in or on the edge of the natural area arise from food processing, sugar refining and poultry plants. Oil discharges from surface water sewers regularly pollute the Little Ouse and Lark in Thetford and Bury St Edmunds.

Increasing recreational use of the countryside includes the river valleys which can be attractive places to walk. Organised activities such as sailing, canoeing, fishing and bird watching are carefully zoned at Lackford Lakes. It will be important to plan to avoid conflict from human disturbance on species such as nesting wildfowl and otters. Formal navigation rights exist only on a short section of the Little Ouse to Brandon within the Natural Area.

The Ely Ouse catchment management plan is a key Environment Agency document and review process which, amongst many objectives, sets out to ensure that environmental water standards are set correctly, monitored, and met.

## Evaluation of the wildlife resource

The importance of the river valleys can be judged by the strong concentration of County Wildlife Sites in both Suffolk and Norfolk on the main rivers and their tributaries (see table 5). The Wissey is probably the finest and although it is not classed as a nationally important river a significant length does flow through the Stanford Training Area SSSI.

Nationally important open water bodies include the natural, unfluctuating meres in Wretham Park and man made pits/lakes at Lackford Lakes and Didlington Park Lakes. All are key sites for waterfowl, together with Stanford Water in STANTA and Thompson Water at the head of the Wissey tributary that flows across the training area. Fen and wet grassland sites include Horse Meadows, Hooks Well Meadows, extensive areas of the Stanford Training Area, and land at Cavenham adjacent to the Lark. Carr woodland forms part of several SSSIs including the Stanford Training Area, West Stow Heath, Thetford Golf Course and Marsh, and Cavenham and Icklingham Heath.

Both the water vole and otter are short listed by the Biodiversity Action Plan as globally threatened/declining species. Breckland is considered to be important in a UK context for water voles although recent survey shows a severe depletion probably due to the presence of mink, and fragmentation of suitable habitat. Barbestelle bats are also rare and on the globally threatened short list. Breckland has an especial responsibility for their protection.

**Table 5 - Rivers and their Valley Habitats - Facts and Figures**

<b>The resource</b>	<b>Number with river valley habitats</b>
Nationally important sites (SSSIs)	13
Sites of natural area importance (County Wildlife Sites)	101
<b>Key species and species groups</b>	
<p>The following Biodiversity Action Plan-listed species are associated with river valley habitats and have important populations in Breckland. River water dropwort (<i>Oenanthe fluviatilis</i>), Water vole (<i>Arvicola terrestris</i>), European otter (<i>Lutra lutra lutra</i>), Gadwall (<i>Anas strepera</i>).</p>	
<p>Bat species make especial use of the river valley habitats as feeding grounds for insects - the 10 Breckland species are Barbastelle, Serotine, Brandt's, Daubenton's Whiskered, Natterer's, Leisler's, Noctule, Pipistrelle and Brown long-eared. All are BAP-listed.</p>	

## **Breckland Issues and Current Factors**

- Many issues affecting the hydrology and management of spring-fed wetlands also apply to river floodplain habitats. Land drainage, groundwater abstraction and the abandonment of the economic use of fen and carr habitats has led to a reduction in their wildlife quality. Other key current factors are
- River water quality is affected by diffuse pollution from agricultural sources. Nitrate pollution of the Wissey in winter requires blending of river and groundwater at the Stoke Ferry public water supply intake. Water quality is also affected by sewage treatment work discharges and low flows due to drought. Minimum river flow regimes are not yet defined for Breckland rivers.
- The restoration of in-river features, previously destroyed, such as riffle-pools in over-widened channels or meanders would benefit wildlife. A Breck rivers restoration project by the Environment Agency is beginning this process.
- The way the Groundwater Development Scheme is operated will be fundamental to the volumes used and the extent of impacts from groundwater abstractions. The environmental affects of pumping from the Breckland aquifers requires thorough monitoring. River support pumping does ameliorate the affects of naturally low flows in dry summers. This has been needed more often since the 1990s droughts to supply water needs outside Breckland.
- Future public water supply may require a reservoir linked to the Breckland river systems. This could have implications for the flow regimes of the Breckland rivers and of the pattern of groundwater use, which will require environmental assessment.
- Demand for spray irrigation will be met increasingly by winter storage from surface abstractions. Maintaining flooding frequencies of valley habitats to sustain their wetland vegetation may become harder in the future. Farm storage reservoirs should be sited to avoid habitats of wildlife value.
- Past drainage schemes within river valleys could valuably be reversed by installing water control structures to ensure wetland dependent plants and animals thrive.
- Pressures continue for intensification of landuse and occasionally conversion of grassland to arable is sought. The Breckland ESA however provides a valuable incentive to retain low-input valley floor pastures and has even supported some arable to grass reversion, although no specific payments exist for this prescription.
- Re-integrating rivers with their floodplains through the re-creation of wetland areas, washlands, and generally higher water levels would be desirable. Higher summer river water levels can be achieved by reduced weed cutting which aims to create a narrower channel of swift moving water that flushes silt from the system.
- The biological information on the species and habitats of river valleys is scattered and many species groups are undoubtedly under recorded. There is a need to bring relevant information together to make a fuller assessment and identify gaps in knowledge.

## **Nature Conservation Objectives**

- Secure the means to achieve practical management of river valley wetland habitats and to restore degraded sites.
- Ensure the full range of characteristic and important wildlife of Breckland's rivers and streams is maintained through adequate flow regimes and high water quality.
- Achieve the restoration of in-river habitat features to benefit characteristic aquatic and riparian species where appropriate.
- Re-establish wet grassland, fen, and reedbed habitats in Breckland river valleys and restore more natural dynamic processes to re-establish the river floodplain function wherever feasible.
- Identify and achieve Biodiversity Action Plan targets for Breckland rivers and valley habitats and the species they support.
- Ensure that populations of nationally important key characteristic or locally rare plants and animals of rivers and their valley habitats are maintained and strengthened.
- Ensure that groundwater development and river support pumping does not detrimentally affect the ecology of rivers or wetland habitats in Breckland.

<b>Management, research and monitoring priorities</b>	Environment Agency	English Nature	MAFF	Landowners/Farmers	Local Authorities	Local Communities	Conservation Organisations	Water Companies
Develop farming systems that significantly reduce diffuse pollution of the water environment	●	●	●	●			●	
Continue the programme of improvements to sewage treatment discharges	●							●
Define minimum flow regimes for all Breckland chalk rivers	●	●						●
Develop a programme of river and floodplain habitat restoration and improvement work	●	●		●	●	●	●	
Improve understanding of groundwater aquifer function to judge environmentally sustainable aquifer exploitation and transfer programmes	●	●			●			●
Develop the ESA and other schemes to further benefit valley wildlife	●	●	●	●	●		●	
Develop present monitoring of surface and groundwater quality for the presence of excess nutrients and pesticides	●		●	●				
Seek means to reduce the detrimental effects of drainage in river valleys	●	●	●	●	●	●	●	
Develop further understanding of the hydrology of valley wetlands to define needs and assess impacts	●	●			●			●
Implement local and national Biodiversity Action Plans including monitoring	●	●	●	●	●	●	●	●
Improve understanding of Breckland's river valley wildlife and habitats		●		●	●	●	●	

## 8. Glossary

### **Agri-environment schemes**

Financial support mechanisms to agriculture which encourage the protection and improvement of the natural environment.

### **Ancient semi-natural woodland**

Woodland which has been present since at least 1600 AD and is therefore presumed to be unplanted and derived, under human management, from the original woodland cover of Britain.

**Biodiversity**

The variety of life forms around us, encompassing the whole range of mammals, birds, reptiles, amphibians, fish, insects and other invertebrates, plants, fungi and micro-organisms.

**Biodiversity Action Plan (BAP)**

A national plan that sets out how the Government will meet its obligations, following our signature of the Biodiversity Convention at Rio, Brazil.

**Carr**

A type of woodland, usually made up of alders and willows, which develops on wet, peaty soil.

**Clearfells**

The relatively extensive areas of felled mature tree crops, before re-planting.

**Environmentally Sensitive Area (ESA)**

The MAFF Breckland Environmentally Sensitive Area Scheme was introduced in 1988 to help safeguard areas of the Countryside where the landscape, wildlife or historic interest is of national importance.

**Invertebrates**

Animals without backbones, this includes insects, snails, spiders and dragonflies.

**Karst**

Any uneven limestone (chalk) topography formed by the eroding power of water above and below ground.

**MAFF**

Ministry of Agriculture, Food and Fisheries.

**Pingos**

Shallow bowl-shaped depressions, many water-filled, formed under the tundra-like conditions in the last Ice Age by freeze/thaw processes.

**Peri-glacial**

Describes the tundra-like conditions in Breckland experienced at the edge of the ice sheets of the last glacial period.

**Red Book Data**

Published lists of animals or plants of conservation concern categorised by internationally established criteria to highlight their rarity and vulnerability to loss.

**Riffle/pool systems**

Areas of naturally uneven river bed where shallow stony bottoms (riffles) alternate with deeper holes (pools).

**Ruderal Habitat**

Waste places, often experiencing soil disturbance, inhabited by plants adapted to such conditions.

**Special Areas of Conservation (SAC)**

Sites internationally important for their habitats and species other than birds and designated under the European Habitats and Species Directive.

**Special Protection Area (SPA)**

Sites internationally important for their bird interest and designated under the European Wild Birds Directive.

**Special Sites of Scientific Interest (SSSI)**

A series of statutorily protected sites that are recognised as being of national importance for their wildlife interests.

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# Appendix 1

## Species of Conservation Concern (as defined by the UK Biodiversity Steering Group Report) for which Breckland supports an important population

English Name	Latin Name	Status	International Importance	Decline	Breckland Speciality in UK
<b>Lichens</b>					
Starry Breck-lichen	<i>Buellia asterella</i>	Sch 8	0	2?	*
Scrambled-egg lichen	<i>Fulgensia fulgens</i>		0	1?	
Scaly Breck-lichen	<i>Squamarina lentigera</i>	Sch 8	0	2	*
<b>Stoneworts</b>					
Lesser bearded stonewort	<i>Chara curta</i>		1?	1?	
Dwarf stonewort	<i>Nitella tenuissima</i>		?	2?	
Tassel stonewort	<i>Tolypella intricata</i>		0?	2?	
<b>Vascular Plants</b>					
Ground-pine	<i>Ajuga chamaepitys</i>	Sch 8, VU	0	1	
Small alison	<i>Alyssum alyssoides</i>	Sch 8, CR	0	2	*
Tower mustard	<i>Arabis glabra</i>	VU	0	2	*
Field wormwood	<i>Artemisia campestris</i>	Sch 8, EN	0	0	*
Slender cottongrass	<i>Eriophorum gracile</i>	Sch 8, VU	0	1	
Blue fescue	<i>Festuca longifolia</i>		0	1	*
Smooth rupturewort	<i>Herniaria glabra</i>		0	0	*
Lizard orchid	<i>Himantoglossum hircinum</i>	Sch 8, VU	0	0	
Smooth cat's-ear	<i>Hypochaeris glabra</i>		0	1	
Spotted cat's-ear	<i>Hypochaeris maculata</i>	VU	0	0	
River water-dropwort	<i>Oenanthe fluviatilis</i>		0	1	
Early spider orchid	<i>Ophrys sphegodes</i>	Sch 8	0	0	
Military orchid	<i>Orchis militaris</i>	Sch 8, VU	0	0	
Purple stem cat's-tail	<i>Phleum phleoides</i>		0	0	*
Prostrate Perennial Knawel	<i>Scleranthus perennis subsp. prostratus</i>	Sch 8, EN	3*	0	*
Spanish catchfly	<i>Silene otites</i>		0	0	*
Breckland thyme	<i>Thymus serpyllum</i>		0	0	*
Narrow-fruited cornsalad	<i>Valerianella dentata</i>		0	1?	
Spiked speedwell	<i>Veronica spicata subsp. spicata</i>	Sch 8, VU	0	0	*
Fingered speedwell	<i>Veronica triphyllos</i>	Sch 8, EN	0	0	*
<b>Mammals</b>					
Water vole	<i>Arvicola terrestris</i>	HD, Sch 5	0	1	
Barbastelle bat	<i>Barbastella barbastellus</i>	HD, Sch 5	0	0	*
Serotine bat	<i>Eptesicus serotinus</i>	HD, Sch 5	0	0	

English Name	Latin Name	Status	International Importance	Decline	Breckland Speciality in UK
Brown Hare	<i>Lepus europaeus</i>		0	1	
European otter	<i>Lutra lutra lutra</i>	HD, Sch 5	0	-1	
Brandt's bat	<i>Myotis brandtii</i>	HD, Sch 5	0	0	
Daubenton's bat	<i>Myotis daubentonii</i>	HD, Sch 5	0	0	
Whiskered bat	<i>Myotis mystacinus</i>	HD, Sch 5	0	0	
Natterer's bat	<i>Myotis nattereri</i>	HD, Sch 5	0	0	
Leisler's bat	<i>Nyctalus leisleri</i>	HD, Sch 5	0	0	
Noctule bat	<i>Nyctalus noctula</i>	HD, Sch 5	0	1	
Pipistrelle bat	<i>Pipistrellus pipistrellus</i>	HD, Sch 5	0	1	
Brown long-eared bat	<i>Plecotus auritus</i>	HD, Sch 5	0	1	
Red Squirrel	<i>Sciurus vulgaris</i>	Sch 5	0	1	
<b>Birds</b>					
Skylark	<i>Alauda arvensis</i>		0	2	
Gadwall	<i>Anas strepera</i>	RDB	0	0	
Stone curlew	<i>Burhinus oediconemus</i>	BD, Sch 1	0	2	*
Nightjar	<i>Caprimulgus europaeus</i>	BD, RDB	0	2	
Hen harrier	<i>Circus cyaneus</i>	BD, Sch 1	0	0	
Woodlark	<i>Lullula arborea</i>	BD, Sch 1	0	2	*
Curlew	<i>Numenius arquata</i>	RDB	0	0	
Grey partridge	<i>Perdix perdix</i>	RDB	0	2	
Redstart	<i>Phoenicurus phoenicurus</i>		0	0	
Stonechat	<i>Saxicola torquata</i>		0	0	
Turtle dove	<i>Streptopelia turtur</i>		0	2	
Barn owl	<i>Tyto alba</i>		0	1	
<b>Amphibians</b>					
Pool frog	<i>Rana lessonae</i>	HD		2	*
Great crested newt	<i>Triturus cristatus</i>	HD, Sch 5	0	1	
<b>Reptiles</b>					
Grass snake	<i>Natrix natrix</i>	Sch 5	0	0	
Adder	<i>Vipera berus</i>	Sch 5	0	0	
<b>Invertebrates</b>					
Water beetle	<i>Agabus striolatus</i>	RDB2	?	1?	
Water beetle	<i>Bidessus unistriatus</i>	RBD1	?	2	
Leaf beetle	<i>Cryptocephalus exiguus</i>	RDB1	?	2	
Ground beetle	<i>Harpalus froehlichii</i>	pRDB2	?	2	
Freshwater crayfish	<i>Austropotamobius pallipes</i>	HD, Sch 5	0	1	
Scarce emerald damselfly	<i>Lestes dryas</i>	RDB2	0	0	

English Name	Latin Name	Status	International Importance	Decline	Breckland Speciality in UK
Hoverfly	<i>Microdon devius</i>	RDB2	0	0	
Soldier fly	<i>Odontomyia angulata</i>	RDB1	0	0?	
Snail-killing fly	<i>Pherbellia knutsoni</i>	pRDB3	?	0?	
Snail	<i>Anisus vorticulus</i>	RDB2	0	2	
Freshwater snail	<i>Lymnaea glabra</i>	RDB2	0	1	
Freshwater snail	<i>Segmentina nitida</i>	RDB1	0	2	
Snail	<i>Truncatellina cylindrica</i>	RDB2	0	0	
Snail	<i>Vertigo angustior</i>	HD, RDB1	0	0	
Snail	<i>Vertigo moulinsiana</i>	HD, RDB3	?	0	
Forester moth	<i>Adscita statices</i>		0	1	
Rush wainscot moth	<i>Archanara algae</i>	RDB3	0	1?	
Marbled clover moth	<i>Heliothis viriplaca</i>	RDB3	0	1?	
Grey carpet moth	<i>Lithostege griseata</i>	RDB3	0	1	*
Lunar yellow underwing	<i>Noctua orbona</i>		0	2	*
Marsh carpet	<i>Perizoma sagittata</i>	RDB2	0	0	
Tawny wave moth	<i>Scopula ribiginata</i>	RDB3	0	1	
Four spotted moth	<i>Tyta luctuosa</i>	RDB2	0	2	
Spider	<i>Clubonia rosserae</i>	RDB1	1?	0	
Capsid bug	<i>Orthotylus rubidus</i>	pRDB3	1	2	

## Key

### Status

RDB	=	Red Data Book RDB1 = Endangered, RDB2 = Vulnerable, RDB3 = Rare) pRDB = proposed for RDB list)
CR	=	Critically endangered
EN	=	Endangered
VU	=	Vulnerable
BD	=	Listed in the EC Birds Directive Annex 1
HD	=	Listed in the EC Habitats Directive Annex II and or IV

### International Importance

3	=	75+% of the world population in the UK
3*	=	believed endemic
2	=	50-74% of the world population in the UK
1	=	25-49% of the world population in the UK
0	=	0-24% of the world population in the UK

## **Decline**

2	=	50-100% decline in numbers/range in GB in last 25 years
1	=	25-49% decline in numbers/range in GB in last 25 years
0	=	0-24% decline in numbers/range in GB in last 25 years
0	=	0-24% increase in numbers/range in GB in last 25 years
-1	=	25-49% increase in numbers/range in GB in last 25 years

## Appendix 2

### Sites of Special Scientific Interest in the Breckland Natural Area

Name	Area (ha)	Habitat/Interest
Bangrove Wood	18.25	Ancient woodland
Barnhamcross Common	67.27	Breckland grass-heath
Barnham Heath	76.50	Breckland grass-heath
Beeches Pit, West Stow	0.40	Geological
Berners Heath, Icklingham	233.50	Heathland
Black Ditches, Cavenham	1.67	Chalk grassland, species
Bridgham and Brettenham Heaths	446.00	Heathland, grass-heath
Cavenham - Icklingham Heaths	398.47	Heathland, grass-heath, fen, woodland
Cherry Hill and the Gallops, Barton Mills	10.09	Chalk grassland, arable species
Cranberry Rough, Hockham	81.40	Basin mire, carr woodland
Cranwich Camp	12.64	Breckland grass-heath, species
Deadman's Grave, Icklingham	126.33	Breckland grass-heath
Didlington Park Lakes	25.90	Lakes, wildfowl, fen species
East Harling Common	14.90	Pingos, fen, species
East Wretham Heath	141.07	Meres, grass-heath
Elm Road Field	5.00	Breckland grass-heath
Eriswell Low Warren	6.60	Breckland grass-heath
Fakenham Wood & Sapiston Great Grove	201.08	Ancient woodland
Field Barn Heaths, Hilborough	18.56	Breckland grass-heath
Foulden Common	136.80	Pingos, fen, grassland, species
Foxhole Heath, Eriswell	84.50	Breckland grass and lichen heath
Gooderstone Warren	21.95	Breckland grass-heath
Great Cressingham Fen	13.69	Fen, grassland
Grime's Graves	64.90	Heathland, grass-heath
High Lodge, Mildenhall	6.90	Geological
Hooks Well Meadows, Great Cressingham	16.06	Fen, floodplain grassland
Hopton Fen	15.24	Fen
How Hill Track	3.30	Species
Knettishall Heath	91.20	Heathland, chalk grassland
Lackford Pits	106.08	Species
Lakenheath Pools Fen	4.95	Fen, grassland

<b>Name</b>	<b>Area (ha)</b>	<b>Habitat/Interest</b>
Lakenheath Warren	570.60	Breckland grass-heath, species
Little Heath, Barnham	45.73	Breckland grass and lichen heath
London Road Industrial Estate, Brandon	0.11	Species
Lordswell Field, Eriswell	3.13	Breckland grass-heath
Maidscross Hill, Lakenheath	45.16	Breckland grassland, species
Middle Harling Fen	12.70	Fen, grassland
Narborough Railway Embankment	7.78	Grassland, species
Old Bodney Camp	32.20	Breckland grass and lichen heath
Pashford Poors Fen	12.20	Fen, grassland
RAF Lakenheath	115.50	Breckland grass-heath, species
Rex Graham Reserve	2.70	Species (cSAC for orchids in chalk grassland)
Stanford Training Area	4597.00	Heathland, grass-heath, fen, carr, meres, pingos, species
The Brinks, Northwold	16.30	Grassland
Thetford Golf Course and Marsh	119.60	Heathland, grass-heath, fen
Thetford Heath	269.36	Breckland grass and lichen heath
Thompson Water, Carr and Common	156.00	Grassland, pingos, woodland, species
Wangford Warren and Carr	65.60	Lichen Heath, sand dunes, fen, carr
Warren Hill	9.91	Geological
Weather and Horn Heaths	130.82	Heathland grass-heath
Weeting Heath	140.80	Breckland grass-heath
West Stow Heath	42.62	Heathland, grassland, carr
Weston Fen	49.56	Fen
Wilde Street Meadow, Mildenhall	10.90	Grassland
Wretham Park Meres	27.47	Lakes, wildfowl