



Broads Authority Biodiversity Action Plan Framework Document

2009



Broads Authority

The Broads - a member of the
National Park family

Prepared by Norfolk Wildlife Services Ltd
and the Broads Authority



Broads Authority

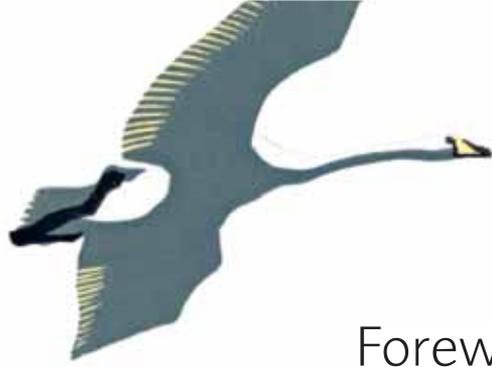
The Broads - a member of the
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Foreword



The Broads is a wonderful place to discover nature, in the words of Ted Ellis "a breathing space for the cure for souls".

There is a long and very valuable history of nature recording of both common and rare species alike in the Broads which provides a unique resource for scientists and policy makers. This Broads Biodiversity Plan builds on our previous strategies and plans for managing habitats and for the first time will provide an organisational focus for biodiversity integration and delivery.

Our objective is to further enhance biodiversity, the habitats and wildlife of The Broads wetland and further develop our sustainable management as the core of Britain's special wetland.

We face new challenges and the uncertainties associated with climate change and salt tides as well as the growing numbers of non-native species. Over the next five years we will build a plan of action, including policies and research-led practical projects.

This Plan demonstrates the Broads Authority's commitment to enhancing biodiversity in this internationally important wetland and we look forward to delivering the Action Plan in conjunction with our key partners, farmers, landowners and local people.



John Packman
Chief Executive





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Executive Summary

1. The Broads is a biodiversity resource of international importance: a mosaic of shallow lakes (broads), reedbeds and fens, grazing marshes, heath and grassland, wet woodland, estuary and coast. These habitats support numerous species of conservation concern, including fen orchid, holly-leaved naiad, water vole, brown hare and bittern. The Broads Authority, part of the family of National Parks, is the body with responsibility for overall delivery of biodiversity within this wetland area covering some 301km².
2. The biodiversity importance of the Broads has been recognised by various national and international conservation designations. Twenty-eight Sites of Special Scientific Interest (SSSI) have been notified, covering approximately 24% of the Broads Authority Executive Area. Most of these sites are of international importance for their habitats and/or bird populations or species and have been included within the European Directives as the Broads Special Area of Conservation and the Broads Special Protection Area. An area of the wetland is also designated under the international Ramsar Convention.
3. One third of the SSSIs are also National Nature Reserves, which highlights both the high level of conservation management and the opportunities for recreational access, where people can visit sites to enjoy the UK's largest protected wetland.
4. Despite these national and international designations, the ecosystem of the Broads is under considerable pressure. This arises mainly from demands for higher levels of food production, waste disposal, infrastructure and small-scale developments as well as reductions in traditional management and the introduction of non-native species. This brings many challenges for managing biodiversity in the Broads. In addition, preparing for the effects that climate change may bring will demand that biodiversity has the ability to adapt in a changing environment. This all requires thinking on a much larger scale, beyond the boundaries of the Broads and into the wider catchment.
5. The Broads Authority with its many partners has been working on a long-term programme to address these issues; finding measures to reduce nutrient pollution from sewage, support traditional habitat management, introducing extensive grazing management and applying innovative biomanipulation to water in the lakes. This activity has been informed by a programme of research and monitoring.
6. The Broads Biodiversity Action Plan (Broads BAP) is made up of two parts. This Framework document describes Broads habitats and species and provides the overall structure for what the Broads Authority will be doing with its partners over the next five years to meet some of these biodiversity challenges. The second part of the Broads BAP is the Action Plan document, and this sets out the actions required by the Broads Authority, working with partners over the next five years (2009-2014). Formation of a Broads BAP group will provide the focus for mapping progress of the Action Plan, challenging current thinking and combining resources to deliver action on the ground.
7. A summary of the key recommendations and mechanisms for delivery contained in the Broads BAP is given on the next page.

Left: *Yellow iris* Below: *Hickling Broad*



Key Recommendations

Partnership working

- Join internally and with other key biodiversity partners to create a Broads BAP group to deliver the Broads BAP
- Work with the County Wildlife Sites Steering Group and landowners to identify and designate County Wildlife Sites on non-SSSI land
- Work with the co-ordinator of the Norfolk Non-Native Species Initiative to develop and manage a programme of works in the Broads to reduce the threats from non-native species
- Work with the Water Quality Partnership to minimise diffuse non-agricultural pollution to improve water quality in the Broads
- Work with farmers and communities to address diffuse pollution
- Join with and influence others in managing land and water to prepare for the impacts of climate change

Resource Management

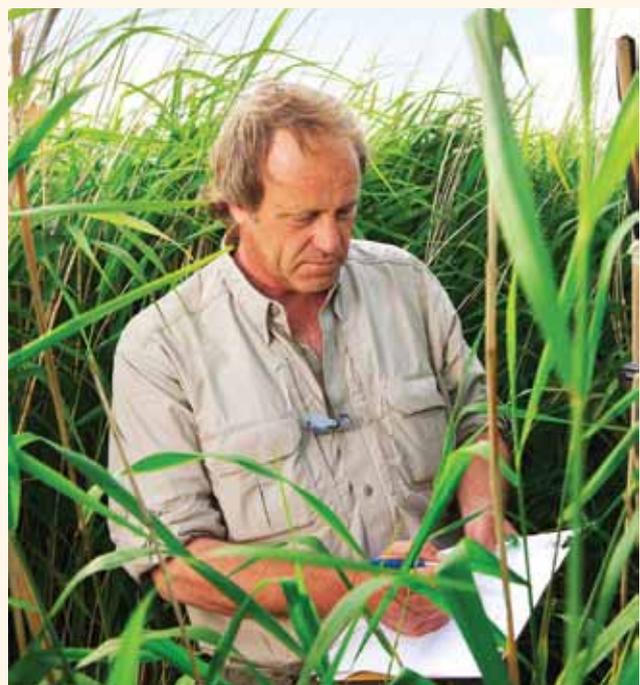
- Plan for further sustainable restoration work, particularly in fens and lakes
- Work closely with Natural England to engage landowners in agri-environment schemes on priority sites to deliver biodiversity gains
- Implement the Fen Management Strategy through the work of the Fen Audit appraisal by using the fen harvester, digger and extensive grazing project
- Deliver short-term climate change adaptation projects as part of the Connecting Wetlands project linking into an ecosystems services approach
- Work as part of the Greater Norwich Development Partnership on the implementation of Green Infrastructure

Broads Biodiversity - Habitat Strategies

- Deliver biodiversity gains at the landscape scale using the Whole Valley Approach
- Implement the Lake Restoration Strategy and Sediment Management Strategy to deliver the long-term programme of lake restoration across the Broads
- Carry out a review of the Fen Management Strategy following the conclusions of the Fen Ecological Survey
- Appraise the Drained Marsh Strategy as required

Recording and Researching the Broads

- Share data with the Norfolk Biodiversity Information Service, the Suffolk Biological Records Centre and other bodies, and develop a programme of monitoring work
- Commit to recording data on the national Biological Action Reporting System (BARS)
- Complete the Fen Ecological Survey and widely disseminate the findings
- Carry out scientific and practical research into restoration techniques, with the emphasis on furthering sustainable habitat management
- Review Broads research programme to identify future themes for research-based restoration



1. Introduction

The Broads is internationally important for its wildlife and habitats and faces particular issues and challenges for the future of this biodiversity resource. This Broads BAP has been produced to bring a focus to these special features and to present an opportunity for partners and those with an interest in the Broads to be involved in biodiversity action. The Broads BAP has been produced within the context of the County BAPs for Norfolk and Suffolk, and provides a strategic document to link to other strategies and plans, including the Broads Local Development Framework.

This Broads BAP therefore is seeking to:

- Bring together knowledge about the Broads biodiversity resource
- Set out the challenges facing Broads biodiversity
- Provide a set of case studies where biodiversity gains have been made
- Focus attention on the work required
- Produce a document to link with other Broads plans and strategies and those of other partner organisations
- Provide a mechanism to bring together those with an interest in Broads biodiversity to work together to meet the challenges ahead.

This document has been prepared by the Broads Authority working with Norfolk Wildlife Services Ltd consultants. The process has involved input from and consultation with a broad range of people:

- Broads Authority staff
- Norfolk and Suffolk Biodiversity Partnerships
- Norfolk Wetland Topic Group

and has been endorsed by the Broads Authority central committee in November 2008.

The Framework Document is divided into seven main chapters:

Chapter 1 Looks at the concept of biodiversity and the international response to the Convention on Biological Diversity, and this is followed by setting out the biodiversity resource in the Broads and the key challenges faced.

Chapter 2 Sets out the approach and principles for delivery of the Broads BAP.

Chapter 3 Covers the main habitats present in the Broads giving a brief review of some of the resources required and case studies carried out which show

successful, practical solutions to some of the challenges.

Chapter 4 Covers the groups of species found in the Broads, looking at their ecological requirements, and setting out case studies where practical work has been carried out. A complete list of BAP species is detailed in Appendix 1.

Chapter 5 Deals with the ecological networks giving a catchment-wide, landscape scale approach to managing the Broads ecosystem.

Chapter 6 Draws together information about research and monitoring work in the Broads.

Chapter 7 Sets out how the task of delivering the Broads BAP will be carried out by the Broads Authority and its partners.

This framework document is closely linked to a five-year Action Plan, which will be operational from 2009–2014, with a key point of reporting on progress being 2010, the EU committed date to halt biodiversity losses. As the Action Plan is reviewed and updated, so the Framework will require refreshing, as undoubtedly the volume of activity resulting from delivery of the Action Plan will impact on the Framework Document.

What is biodiversity?

Biodiversity is used to describe the variety of life on earth. This includes everything from genes to global populations of species, and from communities of species living within a small area of habitat to worldwide ecosystems. Biodiversity maintains the complex web of life, which sustains connections for the health of the planet. It also gives us our natural resources and quality of life. It is an economic resource and can provide cultural heritage, pleasure, spiritual enlightenment and even our sense of wonder.



This means that biodiversity is an integral part of our environment, as well as being a key element of sustainability and a vital part of the Earth's life support system. In times of rapid change to the Earth's environment, biodiversity provides the basis for evolution and adaptation.

Global Biodiversity

The biodiversity planning concept emerged from the Convention on Biological Diversity, which was signed by 150 governments from the United Nations conference held in Rio de Janeiro, Brazil in 1992. This is often referred to as the 'Earth Summit' and is the first global agreement on the conservation and sustainable use of biological diversity. As a landmark document it deals with issues vital to our future. It recognizes that the conservation of biological diversity is of 'common concern to mankind' and is integral to the development process.

The cornerstones of the Convention are fundamental to any plan for biodiversity at any level, and these are cited as:

- The conservation of biodiversity
- The sustainable use of the components of biodiversity
- Creating a fair and equitable share of the benefits arising from the commercial and other uses of genetic resources

The UK, as one of the signatories to the convention, is legally obliged to implement the provisions of the Convention.

UK Biodiversity Strategy

This Convention on Biological Diversity was ratified in the UK in January 1994, and was consolidated into a national publication Biodiversity: The UK Action Plan. This plan sets out national targets for the most threatened habitats and species in the UK, and proposes delivery by developing Biodiversity Action Plans (BAPs). Within these BAP documents the aim is to promote action through compiling specific Habitat Action Plans (known as HAPs) and Species Action Plans (SAPs). These documents identify any declines in a particular habitat or species and importantly, establish recovery targets, setting out what action is needed to bring about improvements to their condition or populations.

The list of HAPs and SAPs was reviewed nationally in 2007, resulting in an addition of over 500 species and 20 habitats to the original 1994 priority list.

Norfolk and Suffolk BAPs

In response to the national strategy, partnership groups in Norfolk and Suffolk have developed, and are working on, implementing BAPs to meet the national habitats and species targets relevant to the two counties.

The Norfolk Biodiversity Action Plan was officially launched in January 1999. The plan was produced by the Norfolk Biodiversity Partnership and currently contains Action Plans for 50 species and 19 habitats. This plan is evolving, particularly in response to the 2007 Review.

The Suffolk Biodiversity Partnership was formed in 1997 and the first group of Action Plans was produced in 1998, with others following between 2000 and 2006/7. There are currently 19 HAPs and 54 SAPs in the Suffolk portfolio.

These Action Plans would not be delivered without the work of both Norfolk and Suffolk Biodiversity Partnerships. One of the aims of both Partnerships is to engage everyone in the biodiversity process: from those with a particular expertise to businesses, individuals and volunteers.

Broads BAP

The Broads BAP is also a local response to the UK Biodiversity Action Plan. It will form part of the East of England BAP and will bring together actions from the Norfolk and Suffolk BAPs that are relevant to the Broads for delivery by the Broads Authority with its partners.

Drawing up this BAP is particularly relevant now as the Broads Authority has new obligations to protect biodiversity through the Natural Environment and Rural Communities Act 2006 (NERC Act). This Act has put responsibility on local planning authorities, including the Broads Authority, who must have regard to Biodiversity Action Plans in determining planning applications. This involves assessing the impact of a development on relevant habitats and species. Assessment can range from a baseline survey to determine presence/absence of BAP habitats and species on a site, through to a fully documented Ecological Impact Assessment within which there will be a section on BAPs.



The silent Electric Eel giving visitors a duck's eye view of the Broads

Broads biodiversity

A range of habitats and species, which have national and international recognition, are found in the Broads. This biodiversity creates a valuable natural resource and the basis upon which much of the local Broads' tourist industry depends.

The Broads is essentially a freshwater system, which becomes more brackish towards the coast. This system comprises rivers and broads (shallow lakes) within shallow valleys, usually with farmland and occasionally heathland and acid grassland on the valley sides. The wetland comprises mainly alder and willow carr woodland, fens and reedbeds and grazing marshes with an extensive dyke system. To the east, on the seaward side of the Broads, Breydon estuary and the coastal dune system at Winterton and Horsey are the dominant saline habitats within the system.

The national and international importance of the Broads is recognized by several conservation designations. There are 28 Sites of Special Scientific Interest within the Broads covering about 24% of the Executive Area. Most of these sites are of international importance and have also been designated under the European Habitats Directive as the Broads Special Area for Conservation (SAC) and under the Birds Directive as the Broads Special Protection Area (SPA), recognizing the importance for habitats and birds respectively.

There are two areas in the Broads designated under the International Convention on Wetland (the Ramsar Convention). These are Broadland and Breydon Water which together cover over 6,500 ha. In addition, one third of the SSSIs are National Nature Reserves, which highlights the high level of conservation management input combined with the opportunities afforded for recreational access, where people can visit sites to enjoy this protected wetland.

Much of the Broads lies outside designated sites, and it is therefore critical to the sustainable functioning of the Broads ecosystem that these non-designated areas are managed to provide functional ecological connections between areas of high quality wildlife habitat. Wildlife corridors enhance resilience that habitats and species have to external pressures, such as climate change.

The Broads hosts many rare species, including the bittern, marsh harrier and swallowtail butterfly, it is also a stronghold for otter and water vole. The Broads is also listed as a proposed UK Important Plant Area; the focus of this listing is on sites within the Broads that support stonewort populations of European importance, fen orchid, calcareous fen vegetation with saw sedge and species of the *Caricion davallianae* (i.e. small-sedge fen with open low-growing sedge vegetation), alluvial forest with alder and birch, transition mires and quaking bogs, hard oligo-mesotrophic waters with benthic vegetation of

stonewort species, and natural eutrophic lakes with *Magnopotamion* or *Hydrochariton*-type vegetation (ie with stoneworts and pondweeds).

The Broads is subject to a number of key external factors which are driving change and will have a major influence on its future. These range from climate change, changes in agriculture responding to global food and fuel needs, and the growing pressures from tourism. Other local management issues also put pressure on the ecosystem, such as disposal of dredgings from the watercourses, management of riverside trees and scrub, and provision of flood defences.

Underlying this is the challenge of managing the rate of change in the Broads. There is a tendency for the wetland components to change ecological condition in a relatively short time and so development of a more integrated approach to managing the biodiversity resource in the Broads is a key component of this challenge.

Challenges for biodiversity in the Broads

Climate change

The low-lying nature of the Broads and its close proximity to the coast exposes the Broads to the impacts of climate change and sea level rise. This has been brought about by sinking land levels combined with increasing temperatures, more stormy weather systems, and changes in frequency and distribution of rainfall.



The most immediate challenges for managing the impacts of climate change on habitats and species are likely to arise from flooding due to tidal surges and the potential for a breach of the coastal sea defences.

Flood banks along most of the rivers in the Broads system protect property, land and buildings from flooding. A programme of management and restoration of the flood defences under the Broads Flood Alleviation Project is currently underway. This is being carried out on a large scale, as the flood bank network has required wholesale refurbishment.



The non-native species floating pennywort

Non-native species

Invasive non-native species are recognised as a significant threat to biodiversity; and freshwater habitats appear to be particularly susceptible. The Broads has become colonised by non-native species such as mink, which predate on water vole (a BAP species), signal crayfish which spreads disease to native white-clawed crayfish (another BAP species), as well as invasive non-native wetland plants such as New Zealand pigmyweed and floating pennywort, which have negative habitat and economic impacts on lake and river BAP habitats.

Experience of controlling invasions of problem species is showing that eradication is difficult and that there is a risk of re-infestation from neighbouring sites or upstream sections if a strategic approach is not adopted.

In a warming climate with more global trade, the existing invasive non-native species problems are likely to get worse and new species will pose additional threats to biodiversity. To effectively raise awareness, monitor and control will require a high level of commitment and additional resources.

The challenges brought about by climate change and non-native species are of unique importance to Broads species and habitats, and to reflect these emerging pressures the Action Plan document focuses on projects to address these.

Habitat fragmentation and isolation

In the past, the Broads was a more naturally functioning wetland, with the whole flood plain acting as a single unit able to provide water storage in times of flood, and release water again during drought. The mosaic of habitats within the system created a complete transition from sea to freshwater, having the ability to manage water quality through removal of chemicals, such as phosphate, into the ecosystem.

Since then, the habitat mosaic has become fragmented, partly by agricultural improvements converting land into arable farming and intensifying the management of grazing marshes. This type of management reduces natural transitions from river to floodplain grazing marsh, fen and reedbed, through to alder carr and into the upland habitats on higher ground.

River and coastal flood defences, required for protecting land including biodiversity features and property on one hand, can present a divide between the flood plain and its river. Where hard flood defences are in place on the coast, the supply of sediment for sand dune building can be restricted. However, separation of some fen and grazing marsh by flood banks from nutrient-rich river water has contributed to maintaining their biodiversity interest.

Scrub management

The landward Broads habitats were maintained for centuries by traditional practices that were once part of rural economies. These practices include reed and sedge cutting for thatching, cutting fen litter for stock and extensive grazing.

Without continued, daily local input managing the fens as open habitat, scrub rapidly invades eventually reverting to secondary woodland. Similarly where reed and sedge is no longer regularly cut, or vegetation grazed, the areas revert to scrub and trees.

Small ponds, known as turf ponds, created by small-scale peat digging gradually succeed to fen and in some cases scrub, and in the process lose the vegetation communities of an open pool.

Clearing scrub as a solution brings its own challenges, including the scale of removal and disposal of cut



100 years ago: the maintenance of Broads habitats by traditional methods



Today: mechanised scrub management

material, and once carried out, a further challenge is present; sustainable management of newly cleared areas.

New initiatives have been brought forward to try to address this using a specially designed fen harvester to cut suitable fen, and using extensive grazing where stock management is feasible.

Waterways management

Years of accumulated sediment in the rivers and lakes has arisen from soil eroded from ploughed land, run-off from hard surfacing, bank erosion and leaf fall. As well as causing the rivers and lakes to become shallower the sediment brings nutrients from farmland, and pollutants from roads and developed areas.



P. H. Emerson's 'Gathering waterlilies' depicting clear water



Sediment management at Malthouse Broad

There has been a long-term, ongoing strategy of sediment removal in the Broads and programme of large scale lake restoration by removal of sediment and development of biomanipulation techniques.

This management approach is not without challenges, as the disposal of excavated sediment and the impacts on aquatic ecology, including the dispersal of non-native species, need to be addressed with each project.

Disturbance to wildlife, particularly wintering wildfowl, can be a significant issue for management of specific waterbodies in the Broads and wildfowl refuges have proved successful in some cases by preventing disturbance to internationally important wildfowl populations.

Water quality

Water quality in the Broads declined considerably during the 20th century, partly from nutrient enrichment from sewage works and agricultural land.

The impacts on the composition of aquatic plants and animals have been dramatic. Although the increase in nutrient initially led to luxuriant plant growth this was followed by a decline in species numbers as the system became over-burdened with nutrients, eventually resulting in algal domination.

These pollutants have become locked up in sediment in the rivers and lakes, creating particular challenges for restoration projects.



Whitlingham sewage treatment works

Most of the sewage treatment works have reduced their nutrient inputs into the water system, but point sources from septic tanks, as well as wider diffuse agricultural sources, remain to be tackled.

Salinity is reaching higher up the waterways due to frequency and length of tidal surge events, posing particular challenges for freshwater biodiversity.

Water quantity

A good supply of water is critical to wetlands in the Broads. Water enters through ground and surface water sources, coming from the wider catchment into the rivers and through springs and seepages arising within the Broads.

Low river flows and reduced ground water supplies together with increased incursion of salt water from tidal flooding present major challenges. On the other hand, the falling levels of water lead to drying out, allowing scrub to take hold.



Good water supply is critical

Resourcing

In order to address these issues and to deliver action on the ground, a high level of investment will be required, both in terms of funding and human resources. The challenges are to make effective use of current resources and to continue to find additional resources into the future.

People from partner organisations and from the wider community are part of this resource pool and the Broads Authority plays a key role in bringing people together and joining resources to deliver actions and achieving shared aims and objectives.



2. Approaches and Principles

The Broads Authority was established under the 1988 Norfolk and Suffolk Broads Act, and has a general duty to manage the Broads for the purposes of:

- conserving and enhancing the natural beauty, wildlife and cultural heritage of the Broads;
- promoting opportunities for the understanding and enjoyment of the special qualities of the Broads by the public; and
- protecting the interests of navigation.

It must also consider the needs of agriculture and forestry, and the economic and social interests of those who live or work in the Broads.

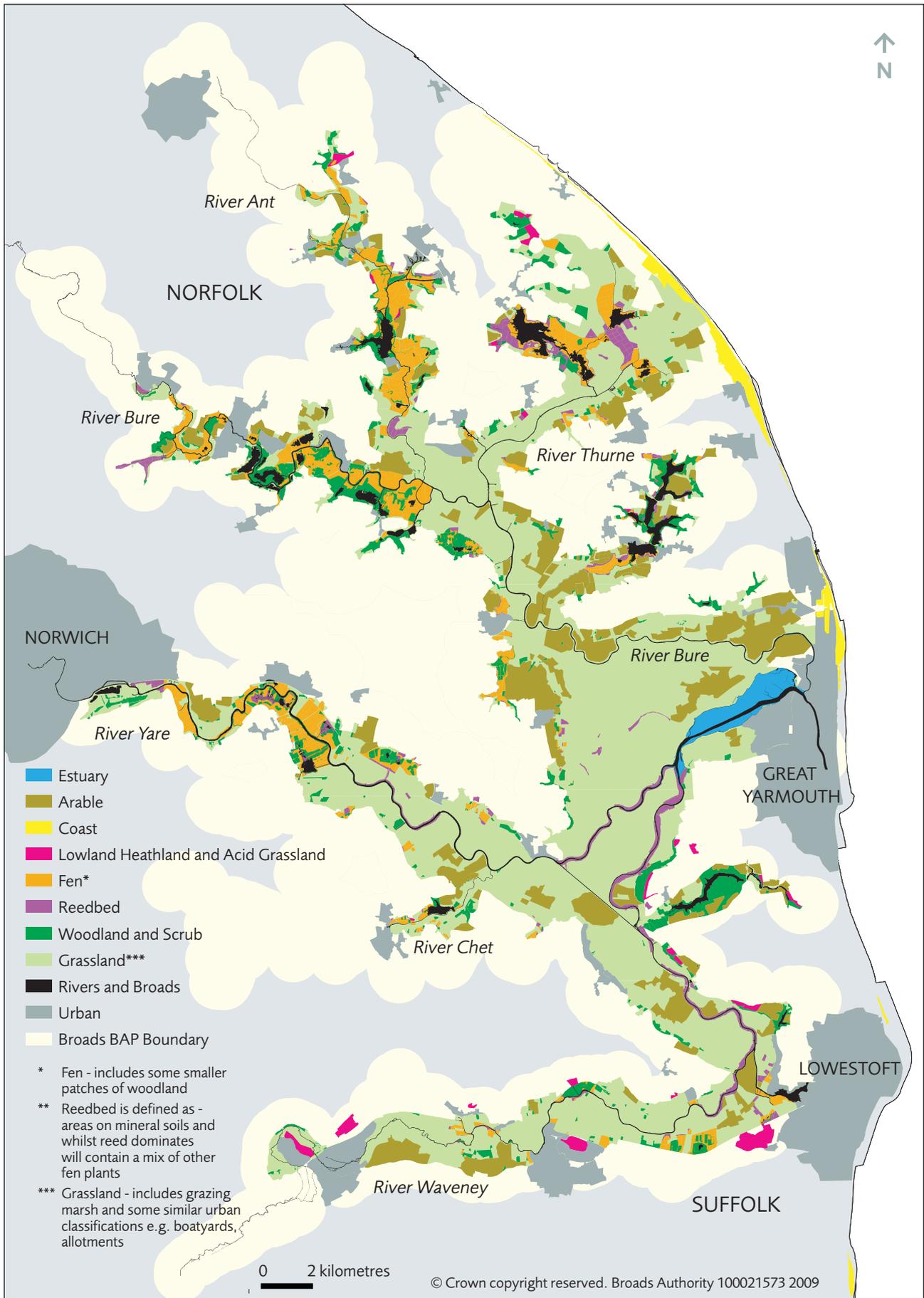
The Natural Environment and Rural Communities Act 2006 (NERC Act) has placed additional responsibility on the Broads Authority and other local authorities to have regard to the conservation of biodiversity in exercising its functions.

This Broads BAP incorporates a set of delivery principles which in turn are linked to the guiding principles adopted in the Broads Plan 2004 (Broads Authority 2004).

In summary these principles are to:

- Work in partnerships with others to deliver the BAP
- Ensure that resources are available to deliver the action plans
- Maintain the natural qualities and characteristics of the environment, including biodiversity, so that it has the capacity to fulfill its full range of functions
- Develop a sound knowledge of the science of natural processes so that they are worked with, rather than against
- Protect the whole range of variation in living organisms, not just rare or threatened ones
- Restore the natural dynamics of the wetland and enhance its ability to carry out natural functions, or ecosystem services, such as flood defence and water quality enhancement. This increases the ability of ecosystems to respond to environmental changes in the long term. This will be crucial when planning for adaptation to the impacts of climate change.

Map 1 Combined Habitats



3. Broads Biodiversity: **Habitats**

Rivers

Length: 122 km (3% of the Broads)

The Broads rivers cover a catchment of around 3,181 square kilometres draining almost two-thirds of Norfolk and much of northern Suffolk. These slow-flowing shallow water courses are mainly fed by chalky water from the underlying boulder clay and show a transition from salt water to freshwater going away from the coast. Over the years the rivers have been modified to take boat traffic and embanked to protect property; however the upper river stretches connect good quality water with important fen and reedbed habitats.

Many of the upper reaches of the rivers system, such as the North Walsham to Dilham Canal on the upper river Ant, have clear waters and host some of the more diverse plant communities, which include water soldier as well as providing an important overwintering site for fish.

Many new embankment works are carried out under the Broads Flood Alleviation Project. The works mostly involve strengthening the banks along their existing alignment although in some places new 'setback' banks are being constructed, which will eventually lead to an increase in connectivity with the river and the creation of reedswamp habitat. The banks themselves provide good habitat for a number of notable species including adder, grass snake and common lizard.

Waterways systems are particularly vulnerable to invasive species, such as Signal crayfish, which find it easy to disperse through the system. Other recent invaders include Turkish crayfish, Asian clam and floating pennywort.

Eels were once regularly caught around the Broads and although their numbers have declined, a traditional net is still set across the river at Heigham Sound.

Case study **Bank protection**

Each year Broads Authority staff and volunteers coppice hazel to make into faggots and poles for bank protection works as well as heathers and stakes for hedge laying.

This low-tech method of stabilising banks from strong wave action has been successfully used at Filby Broad, where faggots were staked across the eroded area three faggots high and then the area behind back filled with reject stone. Willow poles were used to stake the faggots so they would strike root and intertwine through the faggots and stone.

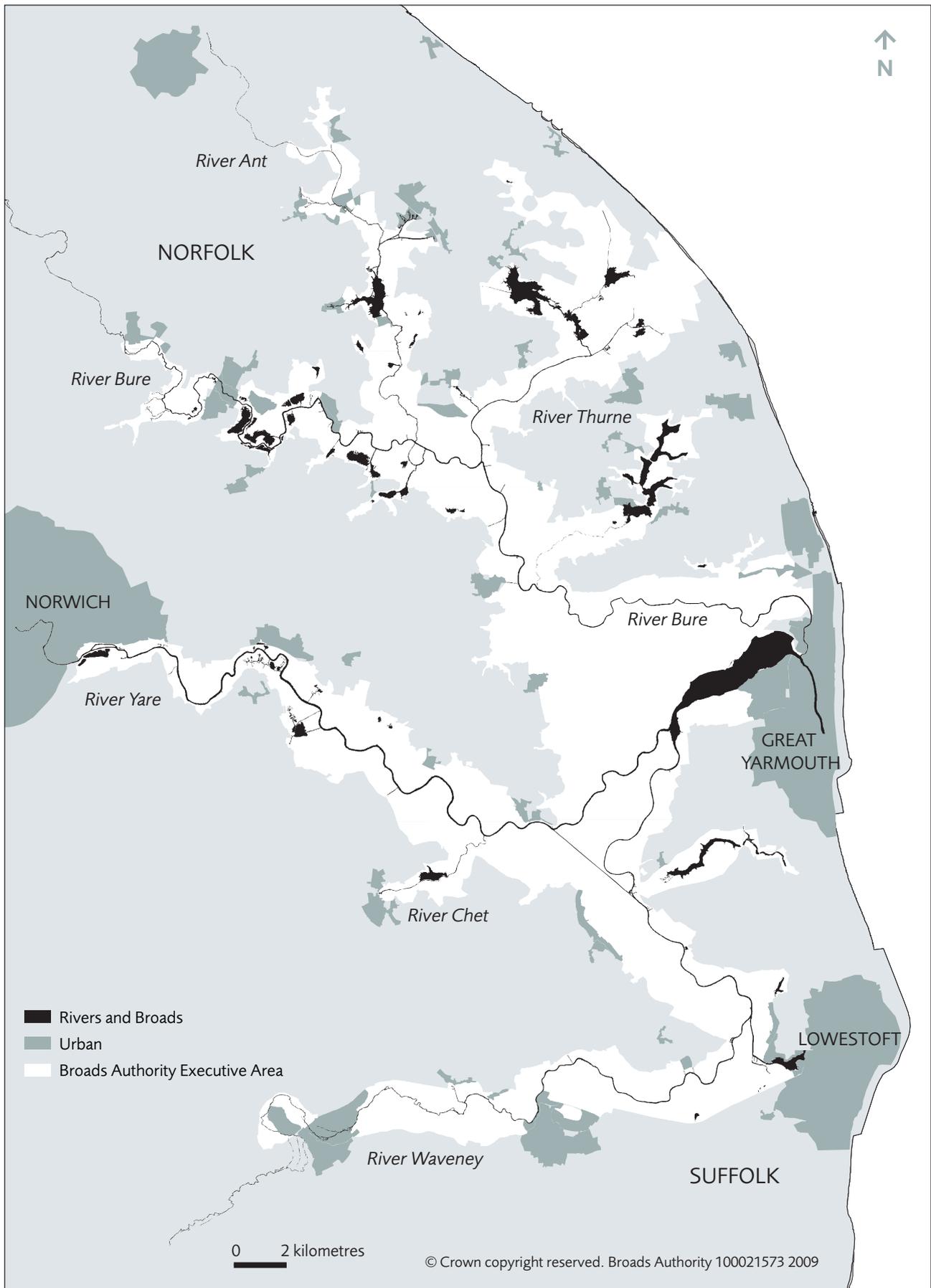
Rivers **Special Challenges**

- Develop skills for managing biodiversity in the river channels and other navigation areas
- Research effects of waterway recreation and channel restoration on biodiversity



The River Bure looking east to the North Sea

Map 2 Rivers and Broads



Shallow Lakes

Area: 906 ha (3% of the Broads)

Originating from shallow peat diggings the shallow Broads lakes harbour different water plant communities which establish in response to the quality of the water. In low nutrient conditions, stoneworts and pondweeds flourish, in higher nutrients water lilies, rigid hornwort, whorled water milfoil and mare's tail are present. Amongst the water plants insects thrive and find refuge from being hunted down by fish. In their turn, otters and bittern benefit from good fishing; and wintering waterfowl benefit from an abundance of aquatic plant food.

The largest lake restoration project in the Broads was carried out in Barton Broad 1995-2001. Mud-pumping removed accumulated nutrient-rich sediment. Improving water quality and the use of biomanipulation has seen some areas colonised by aquatic plants, such as fine-leaved pondweeds.

Barnby Broad is an isolated lake, unconnected to a river system. Accumulated sediment has caused significant water shallowing. Mud-pumping from the lake to land allowed another metre of water depth in the lake. There is potential for hornwort and pondweed species to recolonise as the sediment settles and the water clears.

Holly-leaved naiad and stoneworts are some of the UK's rarest water plants. The Broads is identified as Britain's largest single most important stonewort area. Populations of holly-leaved naiad are recovering as restoration projects are undertaken, and water quality continues to improve.

Shallow Lakes Special Challenges

- Implement measures to reduce nutrients from agriculture
- Moderate water abstraction
- Manage recreational pressure

Case study

Biomanipulation at Ormesby Broad

Ormesby Broad is a 52 hectare shallow lake within the Trinity Broads system, located in the Muckfleet valley, north-west of Caister. These broads are a Site of Special Scientific Interest (SSSI) and a Special Area of Conservation (SAC).

In 1996 a partnership of organisations commenced a major European LIFE-funded project to restore Ormesby Broad. This involved relocating a large proportion of the fish population (10.5 tonnes of roach and bream) from the broad and installing a fish barrier under Rollesby Bridge to prevent fish re-entering the broad (a process known as biomanipulation). This intervention is designed to reduce predation of water fleas by bream and roach, and because the water fleas feed on algae

that would otherwise bloom in the summer months. Increasing water fleas brings clearer water.

Subsequently clear water conditions have been achieved. Both the abundance and diversity of aquatic plant species have significantly increased in Ormesby Broad, and also to a certain extent in the other broads within the Trinity Broads system. This is because the Trinity Broads are a series of interconnected shallow lakes, therefore the changes in Ormesby Broad's fish population has probably had an effect on the fish population in the other broads.

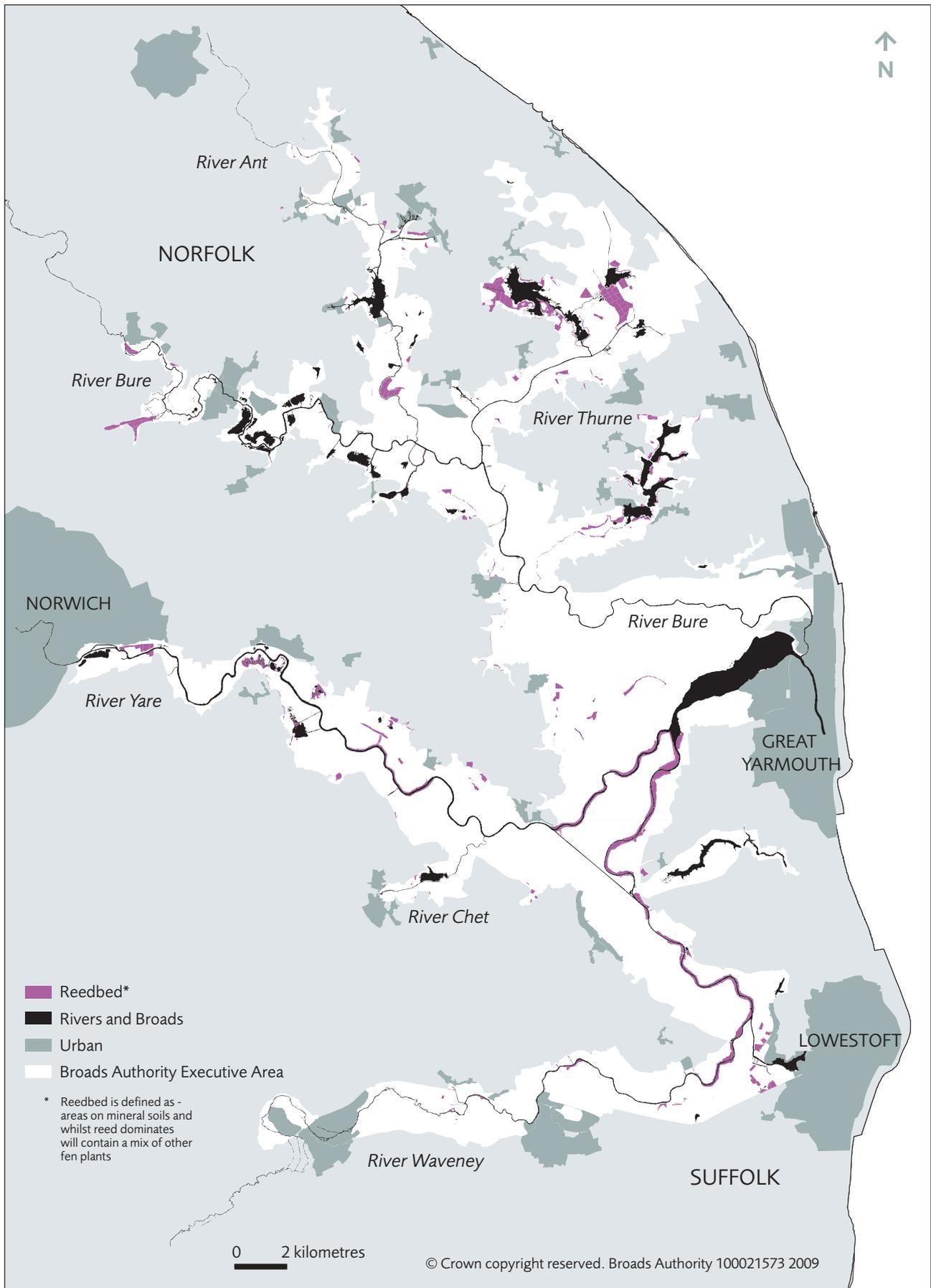
Partnership

The Trinity Broads Partnership (Essex & Suffolk Water, Broads Authority, Environment Agency and Natural England) has been working since 1995 to restore and manage the Trinity Broads and the surrounding reed swamp and woodland.

Martham Broad



Map 3 Reedbed





Reedbed at Strumpshaw Fen

Reedbed

Area: 706 ha (2% of the Broads)

Reedbeds are a common sight in the Broads, edging the waterways and on wet land where reed establishes in higher water level conditions. Reedbeds represent an early successional stage from open water to woodland, and without careful management and control of water levels they will naturally dry out as leaf litter and silt accumulates, eventually allowing the establishment of shrubs and trees.

Bitterns are particularly associated with reedbeds and feed on fish and amphibians that occur in small channels. Marsh harriers also nest low in larger reedbeds and hunt over nearby marshes for marsh birds and mammals.

Reedbeds tend to be dominated by common reed, which provides habitat for bittern, bearded tit, marsh harrier, Savi's warbler and reed bunting. Bittern is a reedbed flagship species in the Broads, which has 23-28% of the UK population of booming males. Numbers of bitterns have increased in recent years following habitat restoration and improvements to water quality.

This habitat also supports a wealth of invertebrates, including some nationally rare and threatened species. A diverse community of invertebrates can be found amongst the common reed, including BAP species small dotted footman, Fenn's wainscot and reed leopard moths.

Integrated management of water and reed itself is fundamental to reedbed management. Reed cutting is carried out in winter, and cutting annually or biannually will provide reed for commercial thatching.

A less frequent cut creates habitat variety for many species. Accumulating reed litter will cause drying out but if water levels are raised an enhanced wet habitat increases rate of litter breakdown.

Reeded ronds (the river bank in front of the flood bank) provide the important role of flood storage, an area in direct connection to the river and can if healthy resist wave energy and prevent erosion.

Case study **Buttles Marsh**

Buttles Marsh is 31 hectares of recently created wetland habitat, including reedbed, fen and marsh, which was taken out of arable cultivation in 1999. The site is isolated from pump-drained marshes and has reverted to fen habitat with natural water levels with input from rainfall and ground water. The resulting wetland has already developed a mixed plant community with milk parsley and swallowtail butterflies. Bearded tit has already bred in the established reedbed and otter, water vole and bittern feed in the shallow pools and dykes.

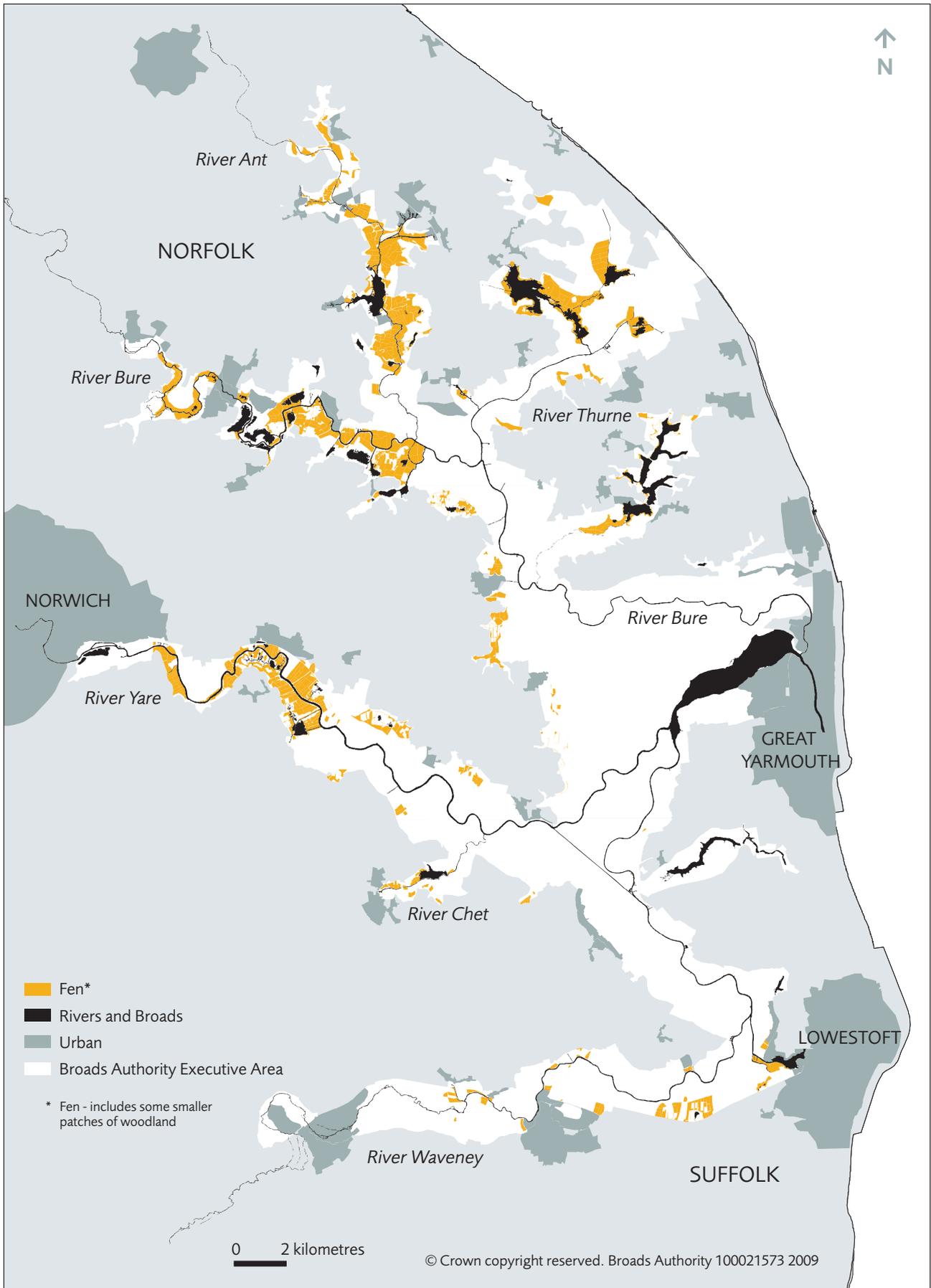
Partnership

Funding for the land purchase was via an RSPB-led European Union LIFE project, with match-funding from the Broads Authority and Natural England.

Reedbed Special Challenges

- Connect and manage reedbeds to reduce fragmentation
- Manage water supply
- Carry out research into the ecological requirements of invertebrates

Map 4 Fen



Fen

Area: 3193 ha (11% of the Broads)

The Broads has the largest expanse of species-rich fen in lowland Britain: a habitat strongly associated with peat substrates. Through years of human management, cutting sedge for thatching, taking a hay crop and light grazing, the fens have developed a diverse vegetation mosaic, which is rich in invertebrates and plant species. Fens are strongly dependent on water supply, and most are not embanked and therefore are in direct contact with river water.

Fen orchid is found within fen vegetation mosaic, some of which is cut on an annual or four-year rotation. The fen orchid found in the Broads has a distinct genetic fingerprint, which is different from that found in Wales and on sand dune systems.

Fen vegetation can be very rich in plants and includes species such as common reed, saw sedge, bottle sedge, hemp agrimony, marsh cinquefoil and milk parsley with characteristic fen meadow plants black bog rush, blunt flowered rush, marsh thistle, and purple moor grass.

Milk parsley provides the foodplant for swallowtail butterfly caterpillars. Adult swallowtails feed on a range of other fen herbs, such as ragged robin and marsh bird's-foot trefoil.

Species-rich fen



The new wetland harvester project began in 1997, funded by the EU LIFE Environment Programme and other funding partners, and has become an integral part of fen management in the Broads, making it possible to maintain large areas of wetland habitat to enhance biodiversity.

Case study Fen Ecological Survey Project

An initiative to re-survey the fens vegetation and key invertebrate groups was started in 2007. This builds on a 1993-95 survey which set the scene for fen restoration and management work using novel techniques such as the fen harvester. The results are due in 2010 and will help to assess the impacts of management prescriptions for fens under the ESA scheme. The information will also provide an indication about the condition of the fens and how habitats and associated species may be responding to climate change.

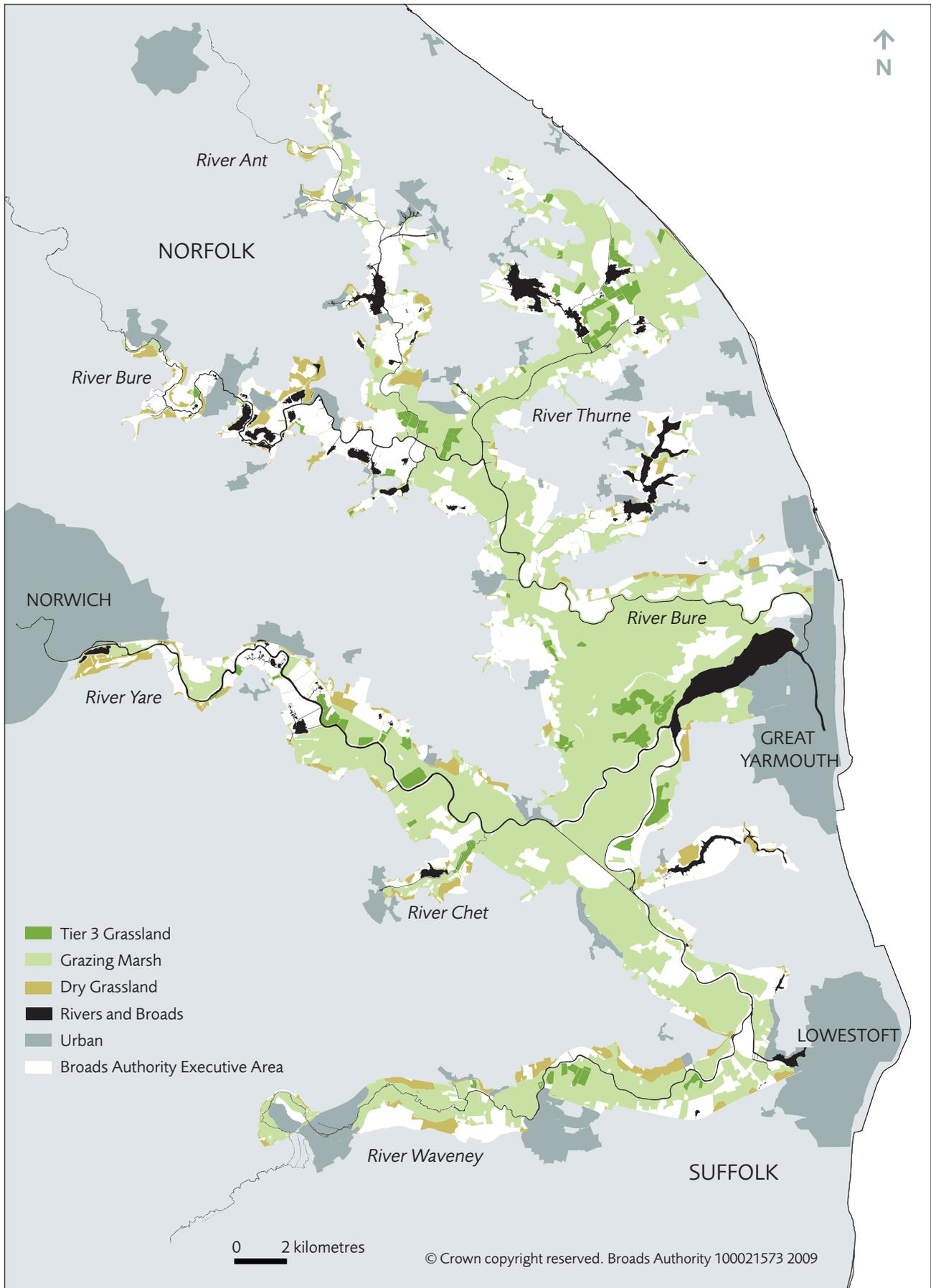
Partnership

Funding partners are Natural England, Broads Authority and Essex and Suffolk Water. Close working with landowners, including conservation bodies has been important.

Fen Special Challenges

- Reduce isolation of fen sites by creating and reconnecting habitats
- Introduce sustainable management to keep vegetation under control

Map 5 Grassland





Halvergate Marshes

Grazing Marshes and Dykes

Area: 11844 ha (40% of the Broads)

Years of land reclamation from an original estuary have given rise to the Broads grazing marshes. Drained land was required initially for sheep grazing, but eventually cattle have come to dominate the marshes. Traditional grazing has led to the development of species-rich grassland vegetation which still survives in some of the less intensively managed parts of the system. The marshes are criss-crossed by a network of drainage dykes, some echo the sinuous former estuarine channels, whilst others are new cuts, straight and long.

The original drainage of the marshes was carried out first by windmill, and then fuel driven or electric pumps. Where marshes remain wet, waders and wildfowl are abundant. Berney Marshes provide a good example of successful management; where wetting up the marshes has attracted wetland birds.

Agricultural intensification resulted in many of the former grazing marshes being ploughed up in the 1980s. The Broads Grazing Marsh Conservation scheme, followed by the first Environmentally Sensitive Area (ESA) in the UK has provided incentives for reversing the trends in declining biodiversity interest by achieving higher water levels and reducing fertiliser inputs.

The grazing marshes are still a considerable wildlife resource and the dyke network is of outstanding importance for its plant communities. Amongst the species found are frogbit, water soldier and broad-leaved pondweed. Great water parsnip and cowbane may be seen growing along the dyke edges.

The Broads is a stronghold for water voles, which are widespread in many of the marsh dykes. The Broads mink management programme is working with landowners and gamekeepers to help keep populations of the non-native mink in check so that water vole populations remain secure for the future.

The Broadland Flood Alleviation Project works benefit freshwater marsh dykes through providing an appropriate standard of protection against flooding with river water that can be high in nutrients and/or salt content. The works can also have

negative impacts through loss of grazing marsh and disturbance to species during construction. However, various mitigation techniques have been successfully developed to minimise impacts on species and the design of the new soke dykes has provided improved habitat for birds, water voles and many other species

Case study Berney Marshes

Over the past 10 years the RSPB has been improving its site at Berney Marshes reserve for breeding waders. This work has seen the population grow from 120 pairs in early 2000 to 330 pairs in 2008.

This success has been the culmination of implementing simple water management techniques using existing foot-drains to provide suitable habitat conditions for wader chicks, backed up by scientific research. Two PhD research projects have improved understanding of how wading birds use grazing marsh and have clearly demonstrated what is needed to improve the productivity of breeding redshank and lapwing on wet grassland sites.

This knowledge has been backed up by working in partnership with local graziers and landowners to achieve suitable grass lengths for the birds but also ensuring that the needs of the graziers are taken into consideration.

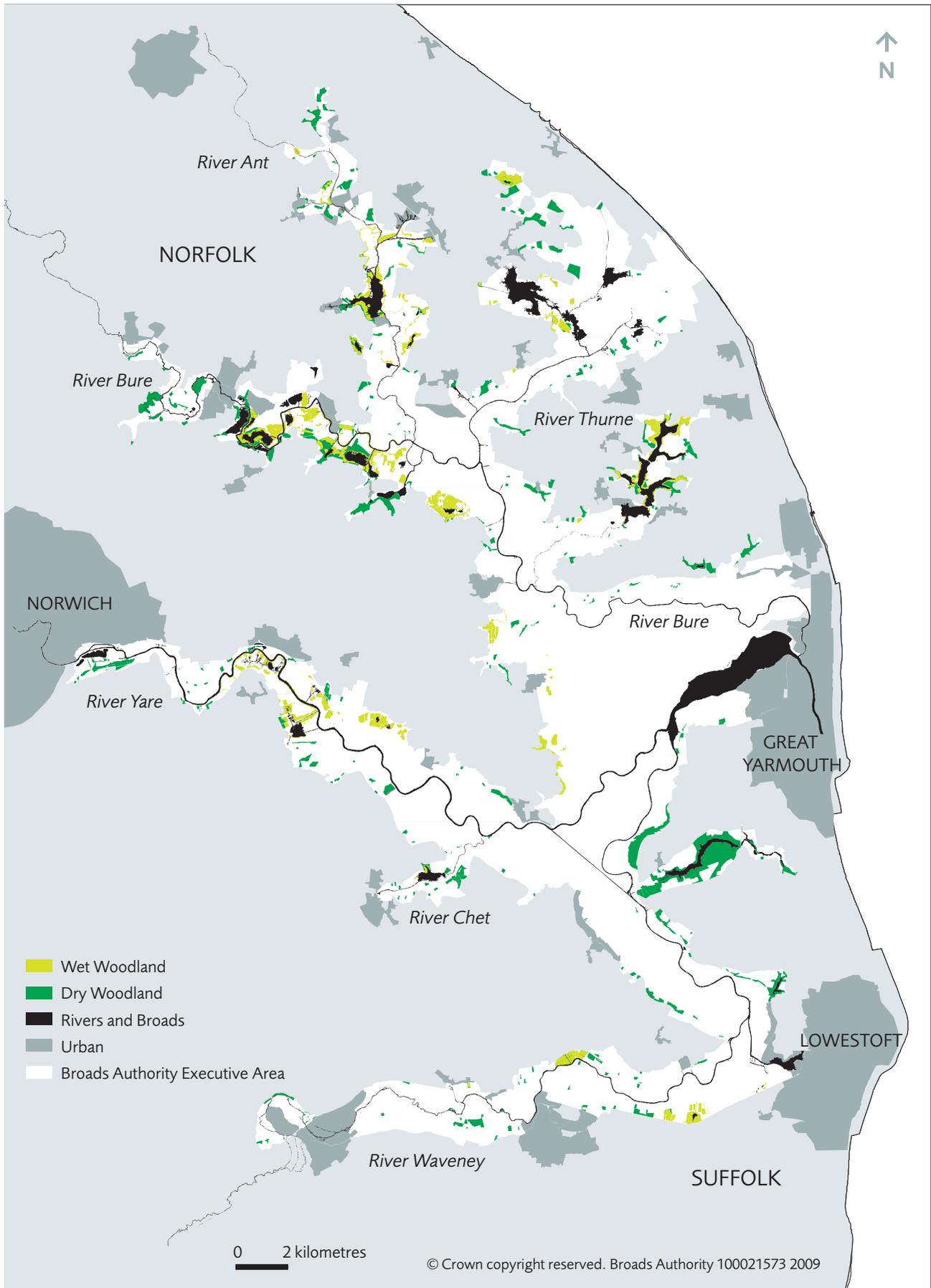
Partnership

RSPB working with the ESA scheme and other neighbouring landowners, including the Water Management Alliance (WMA) (formally the Internal Drainage Board, IDB).

Grazing Marshes and Dykes Special Challenges

- Improve dyke water quality and maintain water supply
- Improve management through Environmental Stewardship
- Retain connectivity via flood defence works
- Manage encroachment of leisure/household activities onto grazing marshes from adjacent settlements e.g. ponds, stabling and horse fencing, allotments

Map 6 Woodland



Woodland and Scrub

Area: 1604 ha (5% of the Broads)

The Broads has the most extensive tracts of wet woodland in lowland Britain, located on the river flood plains and along smaller streams. The biodiversity of these floating forests and wet woodlands is of international importance. Some have been standing for over a hundred years, and were often coppiced for wood products. Other wooded areas are relatively recent having regrown from cleared areas back to scrub and secondary woodland. Many of the woodlands are now unmanaged and comprise an almost untouched plant and animal community subject to little disturbance.

The woodland mosaic includes willow scrub, birch scrub and alder carr woodland, in relatively even-aged stands with oak woodland on higher ground. Alluvial alder woodland is considered of international importance. The different stand types have an associated ground flora which includes great tussock sedge, yellow loosestrife and yellow pimpernel. In some places woodland grades subtly into scrub, fen, marginal vegetation and open water, showing rare examples of a complete hydroseral succession.

One of the woodland vegetation communities is nationally rare. It is described as a fen scrub

community, characterized by grey willow, downy birch and common reed and is almost entirely confined to East Anglia. It also has a specialist sub-community which includes bog moss *Sphagnum* ssp. and is limited to more acid sites, particularly in the Ant valley.

Alderwoods are particularly noted along the Waveney Valley, which were once coppiced regularly to supply straight poles to make charcoal for the gunpowder industry. Today alder is re-coppiced in some woodlands providing straight poles for piling, which is used to give a more natural edge to protected banks.

Woodland and scrub tends to develop along unmanaged edges to the waterways, providing corridor habitat for breeding birds, otters and bats. When management is required to keep passage along the waterways clear of hazards, the trees and scrub are surveyed first to ensure wildlife needs are built into management options. The woodland edges are used as foraging areas by barbastelle and pipistrelle bats.

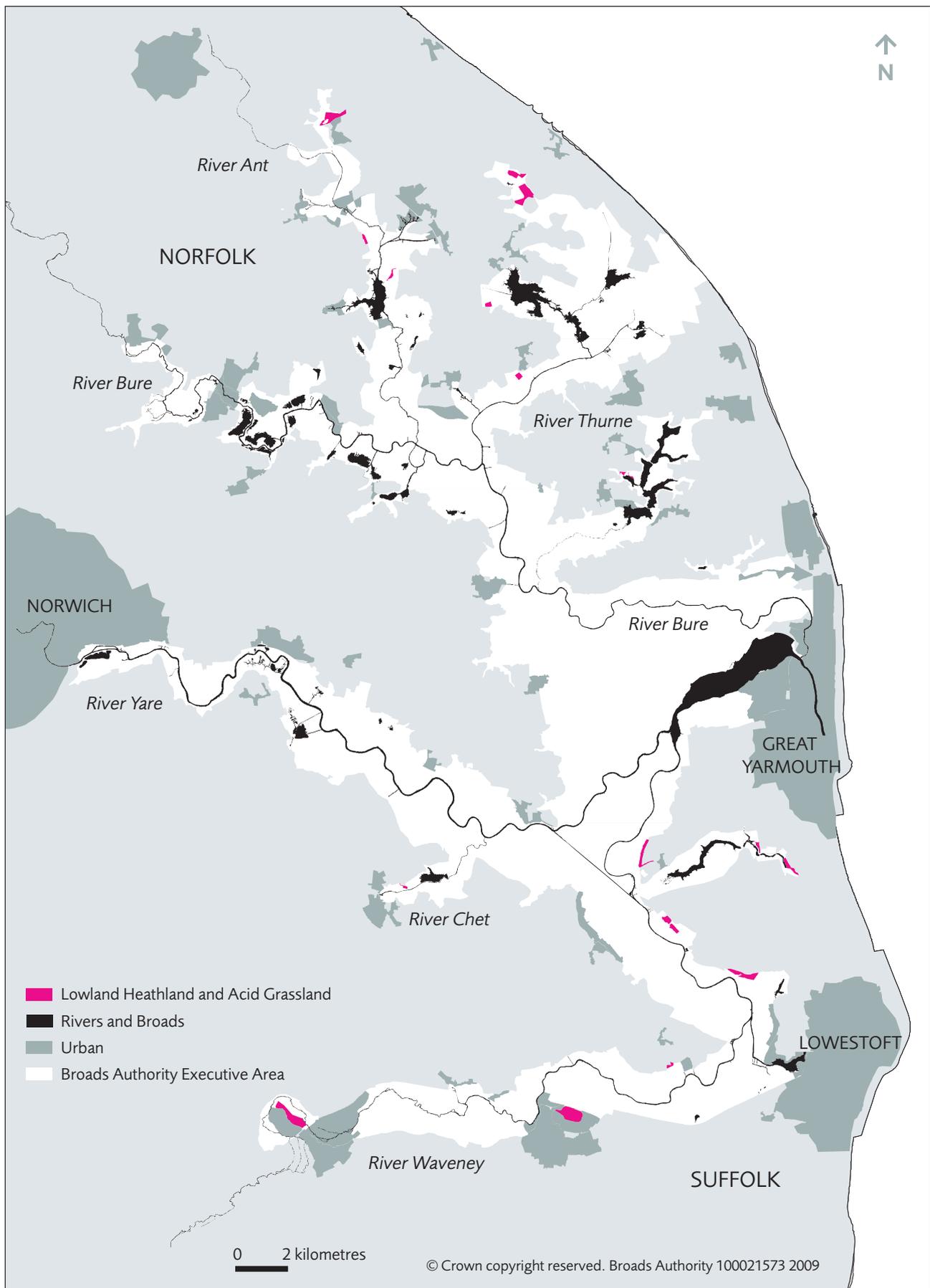
Woodland Special Challenges

- Create new woodland and scrub areas
- Manage waterway woodlands and scrub to maximize biodiversity

Wet woodland edging Barton Broad



Map 7 Lowland Heathland and Dry Acid Grassland



Lowland Heathland and Dry Acid Grassland

Area: 196 ha (1% of the Broads)

Both lowland heathland and dry acid grassland occur on the higher land and valley sides above wet woodland and fen and reedbed habitat, and grade into the wetland with wet habitats such as wet heath and mire. This habitat mosaic is typified in the upper Ant Valley.

Heathland is characterised by the presence of shrubs such as ling heather and European gorse, forming a mosaic with acid grassland and bracken. Acid grassland is characterised by grasses such as sheep's fescue and common bent with sheep's sorrel, heath bedstraw and tormentil. The drier land with gorse and bracken is particularly favoured by adder.

Adder is the only native venomous snake found in the UK. Adders can be found along the flood banks in the Broads as well as on the heaths and along the coastal strip. These animals are actually placid and retiring creatures and need to be left to bask in the quieter corners and to keep disturbance to them minimal. Adder can be identified by the distinct zigzag stripe down its back and the V or X shape marking on the head.

The substrate of many of the upland areas in the Broads provides the right conditions for heathland

Heather and gorse



development. Opportunities for heathland restoration and creation are currently available through the Environmental Stewardship scheme.

Case study

Heathland restoration in the Ant valley

A trial to recreate heath is underway in the Ant valley using funding from Environmental Stewardship. The project is stripping nutrient from the soil by cropping with a non-fertilised spring cereal followed by the use of different restoration regimes. These include reintroduction of harvested heather, with some of the site being left to regenerate naturally and the remainder being spread with dwarf shrub cuttings. The long-term aim is to manage the site with extensive grazing.

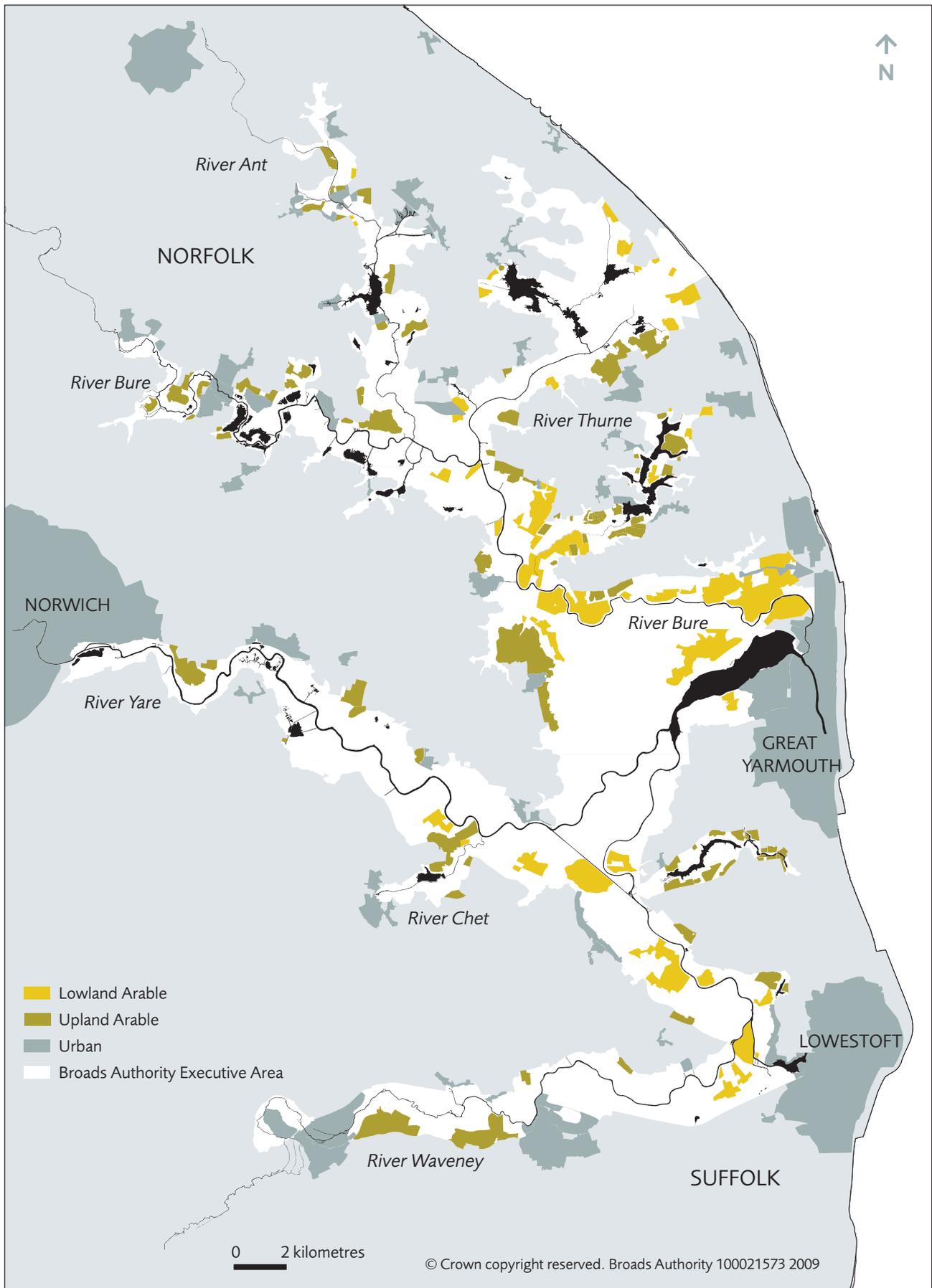
Partnership

The landowner working with Natural England under the Environmental Stewardship scheme in partnership with the Broads Authority and Norfolk County Council.

Lowland Heathland and Acid Grassland Special Challenges

- Manage trees, shrubs and bracken
- Manage encroachment from ad hoc developments such as infrastructure for horses. Assess proposals for mineral extraction, intensive farming and leisure developments

Map 8 Arable





Poppies and oxeye daisies on the margin of an arable field

Arable

Area: 4568 ha (15% of the Broads)

Arable land comprises cropped land converted from floodplain grazing marsh and land on the upper slopes of the valley sides. This land use generally requires addition of fertilizer, herbicides and pesticides to manage crop production. Some wildlife can co-exist with this regime particularly where features such as field margins, hedgerows and trees are present.

Where margins are left around arable fields a diversity of arable weeds can flourish. These plants contribute to the biodiversity of the farmed landscape providing seeds for birds and nectar and pollen for invertebrates. The margins may also provide good food-hunting grounds for reptiles and amphibians when in close proximity to a water body.

Some birds can thrive in a farmed regime. Skylark can be seen soaring and heard calling from arable fields, and where there are good invertebrate sources in the field margins grey partridge may breed. Brown hares also favour arable fields, rearing their young in small shaped 'forms' out in the fields.

Where arable land meets the wetland edges, managing field margins as wide buffer zones can help to reduce diffuse inputs of field sediment and nutrients into the wetlands and waterways. Where

the land is wet enough, managing the buffer as a reedbed can act as a natural filter, removing nutrients before water enters the river.

Case study

Valentines Meadow arable reversion

Valentines Meadow is a 7 ha block of former arable land located on the valley sides. This was taken out of arable cultivation in 1999 and allowed to develop a natural flora. An annual cut controls thistle and ragwort and a colony of marsh and bee orchids has already appeared. Breeding skylark favour the low cut vegetation and several pairs of brown hare are seen hunting across the field. Groups of planted trees will provide shade and cover when the site is grazed. This is an example of a valley side habitat with little water run-off and zero contribution to diffuse pollution.

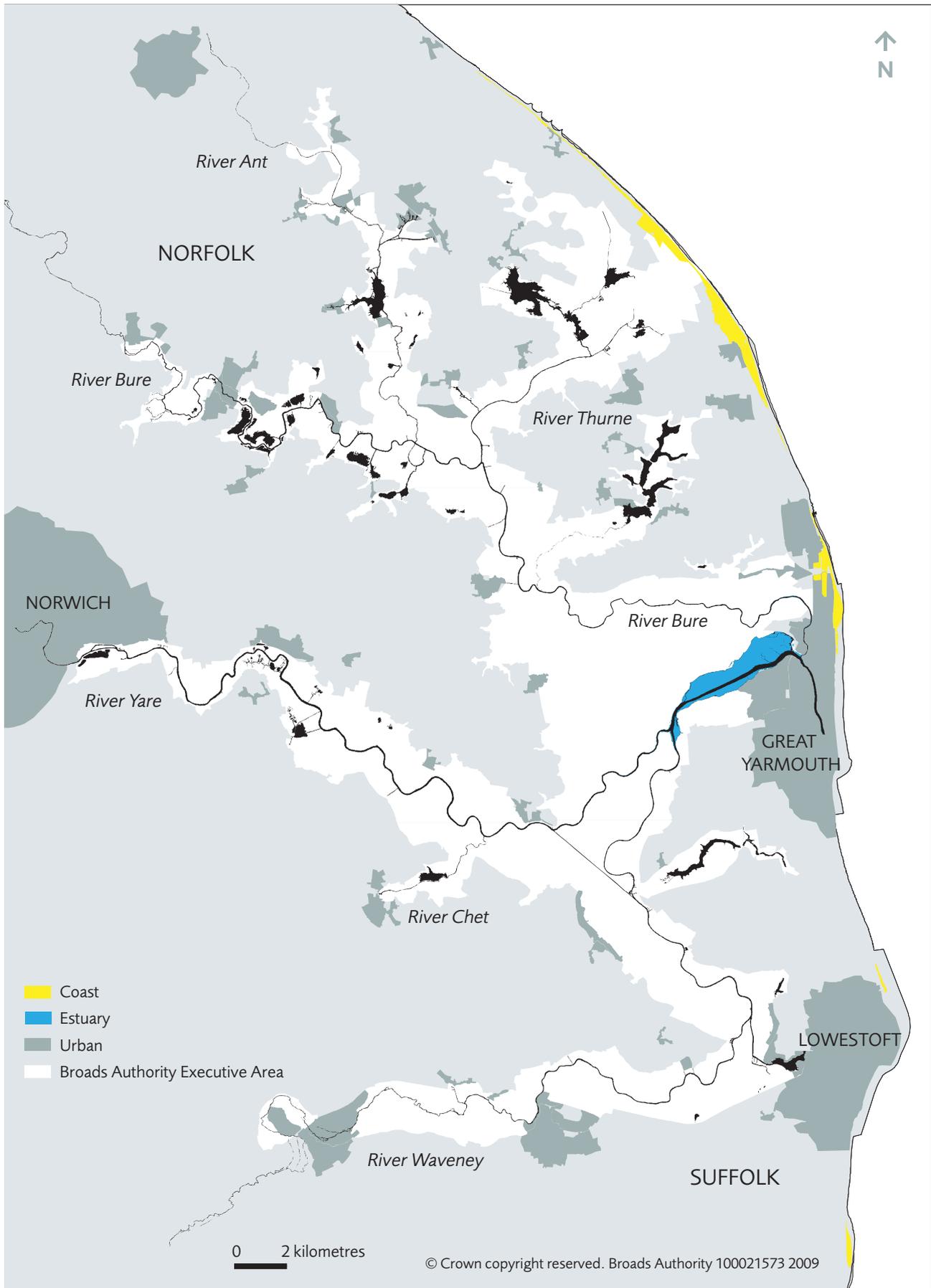
Partnership

The land was purchased with the help of an RSPB-led European Union LIFE project with match funding from the East of England Development Agency and is managed by the Broads Authority.

Arable Land Special Challenges

- Work in partnership to get the best out of agri-environment schemes for biodiversity and water quality

Map 9 Estuary and Coast



Estuary

Area: 376 ha (6% of the Broads)

Breydon Water is Britain's most easterly estuary, situated at the mouth of the River Yare and the confluence with the Rivers Bure and Waveney. It is separated from the North Sea by the spit of land on which Great Yarmouth sits. Extensive areas of mud flats are exposed at low tide where a wealth of birdlife finds good feeding grounds. Its close proximity to the grazing marshes on Halvergate provides the link between breeding grounds on the marshes and feeding on Breydon close by.

Important numbers of the UK breeding common tern population are found on Breydon Water, with around 155 pairs present. The birds prefer nesting on shingle banks, marshes and shallow lagoons. Some of the lakes have artificial rafts installed to help provide breeding opportunities for common tern close to good fishing areas.

Overwintering avocet, Bewick's swan and golden plover are found here in internationally important

numbers. Nationally important shelduck are present with high densities of wigeon, their whistling call echoing over the waters.

The salt marshes found on the higher edges of the mud flats particularly at the eastern end. Saltmarsh plants such as Borrer's salt marsh plant and prickly saltwort may be found here.

The RSPB runs regular environmental educational boat trips across the Breydon estuary allowing local people and visitors to see birds feeding on the mud flats along this 5 km long estuary. Nationally important numbers of wintering and passage waders and waterfowl occur here and the area often attracts rare birds.

Estuary Special Challenges

- Manage the impacts of sea level rise on the mudflat habitats
- Provide a long-term solution to the effects of climate change

Breydon Water





Coast

Area: 480 ha (1% of the Broads)

The Broads is strongly connected to the coast, as the wetland was once an estuary with a characteristic mosaic of habitats from sand dunes and seashore to salt marsh and mud flats. The proximity of the coast not only brings additional biodiversity alongside the freshwater system but also influences the local climate of the Broads.

The low-lying coastal strip between Eccles-on-Sea and Winterton-on-Sea lies within the Broads. The dunes at Winterton are a dynamic 'ness', whose location has drifted over the years. At both ends of the coastal strip there are low cliffs on rising land and much of the coastline is actively eroding. To protect the dunes from this erosion a 14 km long sea wall was built in front of the dune ridge.

The unusual dunes at Winterton are more similar to those in the Baltic than other sites on the Norfolk coast, as acid-loving plants grow here. Within the wet slacks of the dunes, natterjack toads breed in shallow pools, with churring nightjar, barn owl, skylark and stonechat breeding nearby.

Down on the beach, harbour seal and grey seal can be seen swimming and basking. The grey seal breeding colony is monitored with the help of volunteers, who also work to ensure visitors do not disturb the seals. On the open shingle beach little

terns build their nests. Fencing is put up every year to protect the well-camouflaged eggs from trampling and volunteers warden the beach.

Case study Winterton Dunes

A study into the hydro-geological and chemical functioning of Winterton Dunes looked in part at the state of the natterjack toad population. Important factors for successful natterjack toad breeding are good water quality in temporary pools and a lack of unfavourable extreme wet or dry weather conditions. Plastic lined pools are being used as a temporary solution to deteriorating groundwater quality, along with keeping the vegetation managed. But on a site that has been heavily influenced by human activities, longer term research is needed into the issues of water quality in the context of coastal evolution.

Coast Special Challenges

- Manage the impacts of sea level rise and increasing storminess on the dune habitats and the freshwater systems
- Raise visitor awareness about their impacts on dune systems and wildlife
- Carry out research into water quality issues for biodiversity

4. Broads Biodiversity: **Species**

Water vole and Otters

Water voles are the largest species of vole in the UK and live in burrows close to the water's edge. They favour soft banks with fringing vegetation for their burrows and runs. Declines in water vole populations have been largely due to habitat loss and predation by mink. Water vole is a protected species and both the animal and its habitat are protected. Many maintenance and recreational activities affect water voles as they live close to the water's edge.

Water voles feed on tall grasses, sedges and rushes on bank-sides and within all wetland habitats in the Broads, creating small 'lawns' of cut vegetation, which can be spotted amongst the taller vegetation. Mostly found in softer banks, they can present particular challenges for maintenance works in marsh dykes.

The introduction of the American mink from fur farms has been directly linked with the declines in water vole populations, even in areas of high quality habitat. The Broads mink management project has been working together with trappers to control mink to keep the threat limited. However, mink are effective at re-colonising from neighbouring territories, and a more catchment wide or regional approach may be more beneficial. There have been indications that the increase in the otter population on the Broads rivers is linked to reduction of mink in some areas.

Otter populations underwent severe declines in the 1960s, due to pesticides in the food chain causing reproductive failure. In recent years populations have increased partly promoted by banning the use of certain pesticides. This recovery has been helped by reintroductions as part of breeding programmes and maintaining extensive stretches of undisturbed habitat as well as clean water with abundant fish populations.



Otter on fish barrier at Barton Broad

Case study **Water vole survey**

The Broadland Flood Alleviation Project has helped improve understanding regarding water voles in the Broads. Extensive baseline surveys for the engineering works indicate the area supports a significant water vole population; the works have resulted in the development of an effective mitigation technique for the project which has resulted in water voles and their habitat successfully re-establishing following the work. The Project makes significant data contributions to the local Biological Records Centres.



Otters are becoming less rare and are well known over the majority of the Broads area, sometimes in small family parties. One of the key factors for otters is a plentiful supply of food, mainly fish but also water birds, frogs and voles. Sometimes half eaten pike can be seen dragged to the shore side.

Their webbed toes and rudder-like tail make otters powerful swimmers and they can use their whiskers underwater as sensing organs. Male territories can cover as much as 40 km of river. Females breed all year round and require less territory, of only up to 20 km. Otters rest up in a range of places, preferring undisturbed habitats within their home range. They may use holes amongst riverside tree roots, enlarged rabbit burrows as well as patches of scrub and tall grass.

Water vole and Otters Special Challenges:

- Work with partners, linking with other projects to control mink populations
- Ensure bank management is water-vole friendly
- Enhance dykes and banks for water vole colonisation
- Create cover and wetland habitat corridors attractive to otters
- Continue to build up a diverse fishery



Banded damoiselle

Dragonflies and Damselflies

Dragonflies and damselflies are particularly dependent on the waterways, starting life in the water as larvae and emerging as adults to breed and lay eggs. Two speciality dragonflies in the Broads are the Norfolk hawker and the scarce chaser along with commoner species such as the southern hawker and the azure damselfly. The loss of wetland, land drainage and pollution of waterways has caused declines in these species on other habitats.

The Norfolk hawker is very distinctive with its green eyes and yellow triangular marking on its abdomen. It appears to be particularly associated with an aquatic plant, water soldier, in clean, non-saline water with rush-dominated margins along a dyke. With recent improvements in water quality, habitat improvements and protection of grazing marshes under the ESA scheme, the distribution of Norfolk hawker has expanded.

Dragonfly larvae live underwater and can take up to five years to mature into adults. They are voracious predators and will eat tadpoles. They prefer vegetated margins where abundant prey is found, and when larvae are mature can climb up stems. From here they emerge from their larval state into the more familiar adults seen hawking around bank-side shrubs, dykes and field edges.

Right middle: Emerald damselfly (female)

Right bottom: Four-spotted chaser dragonfly

Case study

Ludham and Potter Heigham Marshes ditch clearance

At Ludham and Potter Heigham Marshes work has been carried out by Natural England to reprofile existing ditches and create new ones. This work has seen an increase in the population of Norfolk hawker (below) in response to growth of water soldier along cleared dykes. Cattle grazing along the dykes helps keep them open whilst poaching creates a strip of diverse wetland. Since this also tends to infill the dykes they are kept open by rotational clearance, taking one side at a time. This limits habitat disturbance and maintains good habitat for other species such as water vole.



Dragonflies and Damselflies Special Challenges

- Maintain integrated habitat management to encourage dragonflies and damselflies



Water Plants

Submerged water plants are probably the best indicators of ecological health of shallow lakes. Historic plant information has been gained from notebooks of Victorian botanists as well as from fossil remains in survey and report on water plants for the past 26 years.

The drained marshes act as a 'reservoir' for some of the plant species lost from the lakes which amounts to over 108 species of submerged, floating leaved and emergent plants. These include the nationally rare sharp-leaved pondweed, floating water-plantain, grass-wrack pondweed and greater water parsnip. Improvements in water quality and the implementation of the Broads Authority's Lake Restoration Strategy means plants are gradually returning to the upper reaches of rivers and lakes.

Not readily seen, water plant communities are the 'hidden' world of the Broads. A total of 56 species of plants have at some time or another been recorded in the Broads system as a whole, although typically a healthy lake will be one that has at least 15 different species of plants in good numbers.

The Broads remain particularly important for their stonewort populations, and support the richest stonewort flora of any area in Britain: within the UK, intermediate stonewort and starry stonewort are largely or wholly confined to the Broads.

Current UK populations of holly-leaved naiad are confined to the Broads. Historic data gathered through analysis of sediments in lakes across Norfolk confirm that it used to be more widely distributed. Holly-leaved naiad has been found in increasing numbers of broads since 2005.

Stonewort



Case study Little Broad

Little Broad near Fleggburgh was identified as a good candidate lake for restoration. Only two species of plants, namely filamentous algae and horned pondweed, were able to grow in the lake which had a deep mud layer overlain by very shallow water. The excess muddy sediment was pumped out during the winter of 2007. Less than six months later, beds of stoneworts were seen growing in the newly deepened clear water lake; their seeds had lain dormant until the right environmental conditions arose.

Water Plants Special Challenges

- Identify lakes suitable for restoration
- Research the feasibility of using in-lake restoration techniques, such as suction dredging.
- Work in partnership towards improvement in water quality in the Broads.



Water soldier

White waterlily



Fish

There are eight main species of fish within the Broads. These are roach, common bream, rudd, tench, perch, ruffe, northern pike and European eel. Eels were formerly very common but numbers have declined sharply. Several less common but widely distributed species include gudgeon, noted especially in Fritton Lake and the River Ant, and three-spined and ten-spined sticklebacks, which are present throughout the margins of the Broads.

Carp have a more restricted distribution including a presence in the Trinity Broads complex. In the more saline broads and the lower sections of the main tidal rivers (Yare, Bure and Waveney), flounder, smelt and bass are present. Fish populations within the Broads are monitored routinely by the Environment Agency.

Increased water plant cover within the lakes and rivers has seen a response from fish communities with species such as rudd, tench, perch and pike becoming more common. However, the long generation time of many fish species and variable recruitment patterns mean that it may take a long time for characteristic fish communities to develop naturally without stocking and/or biomanipulation.

The Broads Fisheries Action Plan suggests that angling accounts for at least 17 per cent of visitors to the Broads and contributes in excess of £20 million to the local economy each year. The Broads Fisheries Action Plan was developed to bring together four main areas of activity: fisheries management and ecology; access to fishing; information and education; and urban fishery development.



Perch

Case Study Fish refuge

Storms can cause big problems for over-wintering fish in some parts of the Norfolk Broads. A combination of strong north-westerly winds and intense low pressure can push salt water a considerable distance up the lower reaches of Broads rivers. These saltwater incursions can trap freshwater fish in dykes and boatyards when salt levels in the river become too high to allow them to escape. In the mid 1990s a saltwater barrier was installed at Herbert Woods Boatyard in Potter Heigham on the Thurne system. This is hinged on the bottom of the river and can be raised by winches to seal off the fresh water in the boatyard, protecting the sheltering fish. A series of automatic water quality sensors downstream alert Environment Agency Officers to increasing saltwater levels, so they can determine if the barrier will be needed.



Pike

Fish Special Challenges

- Develop conditions to support characteristic fish communities
- Develop a diverse and mixed fishery
- Obtain sufficient monitoring data to guide effective management



Amphibians and Reptiles

The Broads wetland mosaic provides a good range of habitats for amphibians and reptiles. Amphibians such as common frog and toad are attracted to shallow waters with marginal vegetation, and adjacent foraging areas in rough grasslands and hedgerows. Reptiles, as cold-blooded animals, require sunny banks, paths and slopes for basking combined with good hunting grounds nearby.

Common frog and toad breed in ponds and shallow waterway margins where there is a mix of submerged, floating and marginal plants, particularly as cover for tadpoles escaping from hunting fish. The much rarer Natterjack toad breed in shallow pools behind the main ridge at Winterton and Horsey which also supports smooth and crested newts.

Smooth newt is most often found in ponds during the breeding season between February and June. Outside this, newts move away from ponds and onto land inhabiting damp places; particularly underneath logs and vegetation debris. Newts eat small invertebrates either on land or in the water. Their spawn is laid as individual eggs wrapped in a leaf of pond plants by the female newt. Like common frogs and toads they have a tadpole stage before developing into adults.

Grass snake favours rough land and pastures and can often be found on flood defence banks along the waterways. They feed almost exclusively on amphibians although some may take small fish. Grass snakes will only show aggression if cornered and they will hiss loudly, often recoiling into a strike-position. However, they rarely bite and often play dead.

Common lizards are also frequently found basking on stones, logs or grass tussocks along the flood defence banks, paths and sunny trackways around the Broads. Adult lizards emerge from hibernation in March, and mating takes place between April and May. The young are born in an egg sac that breaks either during birth or soon afterwards. This is why common lizard is also called viviparous lizard, as it means bearing live young, as opposed to laying eggs, which is more usual for lizards.

Large populations of adders are found in the Thurne valley, the Waveney valley at Herringfleet and the Waveney Forest. Adders prefer undisturbed countryside and can be found in surprisingly wet habitats throughout the summer months.

Case study Protecting common lizard

Common lizard is a species of consideration for the Broadland Flood Alleviation Project as floodbanks are an important habitat for them in some areas. Where small or localised populations are present habitat management and reptile fencing is used to protect them. Post works surveys in the Waveney valley indicated this approach was successful. Where extensive populations are present additional measures involving phasing of works; translocation of animals; and habitat augmentations are used. The provision of hibernacula made of rubble and logs has been particularly successful. This approach has been employed as part of a four year, 16km scheme adjacent to the River Bure.



Amphibians and Reptiles Special Challenges

- Retain a mixture of land and water vegetation types
- Implement mitigation measures for protecting species during works



Above: Common frogs
Top: Grass snake

Freshwater Molluscs

Molluscs, or freshwater snails, are an important component of the freshwater fauna, and a number found in the Broads are highlighted as key biodiversity species. Living their entire life cycle based in water, freshwater molluscs provide a good indicator of the quality of the water environment, being sensitive to pollution, increased nutrients and sediments.

Sediment cores taken at Rockland Broad revealed that the variety of mollusc species was previously more abundant. The rare large-mouthed valve snail was one of these, now only found in the quieter channels of Wheatfen. The river nerite (a snail) was also discovered, a species of clean running water on sand and gravel beds, now much less common in the Rockland-Wheatfen complex. The common river and Lister's river snails, two muddy bottom dwelling snails, were previously more numerous when nutrient enrichment and sediment inputs were lower.

The whirlpool ram's-horn snail is very limited in its distribution in Norfolk. It prefers slightly more chalky waters, breeding in ditches rich in vegetation but not overgrown with reed. It survives where grazing marsh ditches continue under traditional management, and may spread to new dykes during flooding events.

One of the country's strongholds for shining ram's-horn snail lies within Norfolk and Suffolk grazing marshes. Marsh drains and ponds with well-oxygenated water and lush vegetation are its preferred habitat. Ditch management on a rotational basis is crucial for this mollusc, consisting of partial clearance on a 7-8 year rotation to create open water with stretches of untouched vegetation.

River dredging work brings out molluscs along with accumulated silt. Amongst these is often an abundance of swan mussels, which live part buried in silt, filter feeding on organic particles. Swan mussel larvae attach themselves to fish where they feed until matured when they drop off as adults.

River managers are on alert for the non-native zebra mussel, which cling together forming large reefs. They can cause significant economic damage by blocking pipes, as well as causing environmental changes.

Freshwater Molluscs Special Challenges

- Research habitat and environmental requirements for freshwater mollusc distribution
- Ensure management works in waterways and ditches and dykes favour freshwater mollusc survival

Butterflies and Moths

There are many more moths than butterflies and they inhabit virtually every habitat available. Butterfly larvae, caterpillars, require specific foodplants, from grasses for the speckled wood and gatekeepers, to milk parsley specific to the swallowtail.

The swallowtail is an iconic species in the Broads and one of the rarest and most spectacular butterflies in the UK. This British race *britannicus* is a specialist of wet fen and is currently restricted to the Norfolk Broads. A powerful flier, it can be seen over open fen vegetation, stopping to feed on flowers such as thistles and ragged robin. Its larvae specifically feed on milk parsley, which only occurs on the fens.

The Broads specialty moth Fenn's wainscot, is very locally found, and restricted to a small number of fenland localities although it can be common where it occurs, flying at night in late July and early August. The caterpillar is grey with brownish-yellow stripes and feeds on common reed, initially within the stems and later on the leaves.



Above: Brimstone butterfly
Top: Orange tip butterfly

Just as butterflies have to avoid capture by birds during the daytime, night flying moths have to avoid capture by bats. Moths have sensitive ears, located close to where the hind wings join the body. When they hear the ultrasonic call of a bat, they close their wings, and drop like a stone out of harm's way.

The narrow-bordered bee hawk-moth flies during night and day. It has the appearance of a bumble bee, right down to clear wings and furry body. When it first emerges from its pupa the wings are covered in scales but after the first flight many of them drop off leaving the clear patches. The name 'narrow-bordered' refers to the dark coloured band or 'belt' around the abdomen.

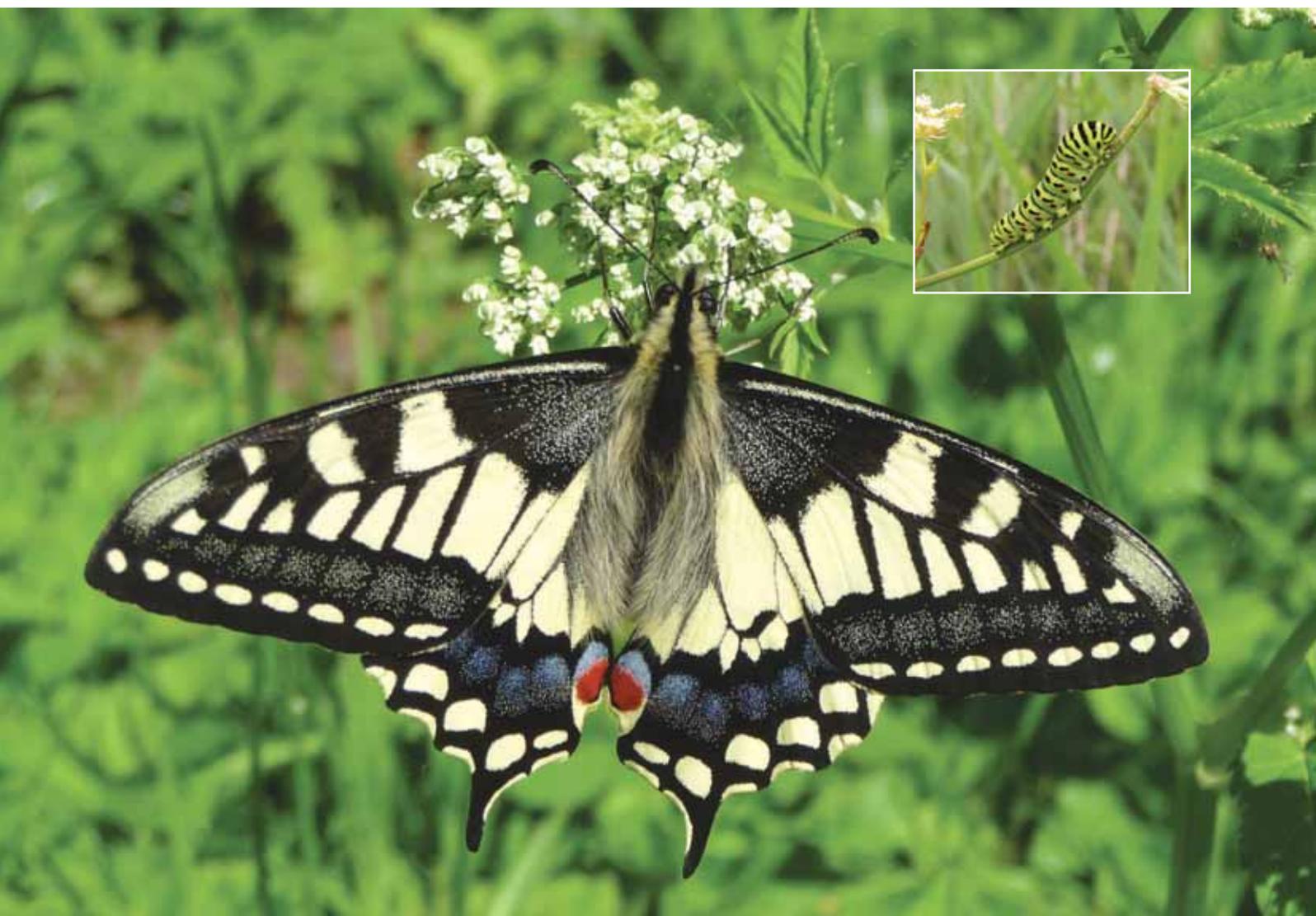
Butterflies and Moths Special Challenges

- Conserve and encourage butterflies and moths by managing vegetation to favour their foodplants



Above: Six-spot burnett moth
Top: Comma butterfly

Swallowtail butterfly and caterpillar





Pipistrelle bat

Bats

Bats are present in the Broads over a broad range of habitats. Bats can be found in all kinds of buildings, bridges and walls where cracks and crevices provide suitable roost, nursery and hibernating sites. The wider landscape mosaic of reed swamp fringed waterways, fens and grasslands, with trees and scrub offer extensive bat foraging and commuting grounds. Bats and their roosts are protected to reduce declines in bat population numbers.

Bats are active at dusk through the night until dawn when they return to their roost sites. During this time they are feeding on insects which bats find by using echo location. A bat sends out sound waves which bounce off an obstacle, which is interpreted by the bat's sensitive system giving accurate location of its food.

Bats will roost in cracks and hollows, particularly those in older trees. Bats can be difficult to detect if they are roosting here, but survey experts can use clues such as dry, crumbly droppings and urine stains to interpret any bat use.

Where trees need unavoidable management then every effort is made to retain important bat features. However, where necessary careful felling techniques are used with expert help to ensure any roosting bats can escape. Opportunities for bat roosts can be enhanced by provision of artificial bat boxes or bat bricks incorporated into buildings or attached to structures.

Daubenton's bat could be described as a water bat as it favours hunting for insects over calm waters in open wooded areas. Summer nursery roosts can contain 20-50 females and may also include other species such as pipistrelles, brown long-eared and noctules.

Bats Special Challenges

- Ensure bats surveys are carried out prior to tree works
- Develop a better understanding of bat distribution across the Broads

Right: Grebe with chicks

Page 45: Top (left to right): Bittern, Sedge warbler, Breasted tit. Middle: Erget. Below Egret (left to right): Kingfisher, Water rail. Bottom left: Marsh harrier

Birds

The Broads is recognized as an internationally important location for bird species. The conditions are created by the proximity of the Broads to the coast, and the variety of wetland habitats present, including grazing marsh, reedbeds, fen and dykes with wet woodlands and scrub mosaic. The area is particularly noted as a staging post for numerous species of migratory birds.

The Broads is an internationally important location for wintering waterfowl and regularly supports over 20,000 birds. These include gadwall, shoveler, wigeon, pochard and tufted duck as well as great crested grebe and coot. Large flocks of birds spend time on open water where they feed and roost, but they can be vulnerable to disturbance.

Bitterns favour the dense cover of reedbeds within sheltered shallow water, where fish, amphibians and insect food is plentiful. Male bitterns make a remarkable, far-carrying booming sound to establish territories and attract mates. It has been established that each 'boomer' has its own signature. The booming attracts females, and males may have more than one nest and female in a locality. The female constructs a shallow platform of reed stems within reedbeds, often close to the water level, where she lays 5-6 eggs.

Reed bunting is frequently seen in the Broads where it is resident and also a breeding bird. In spite of its name, reed bunting breeds near water but not necessarily in reed vegetation. The male is particularly conspicuous with its black cap and white bib and collar, standing high on a stem giving its call. In winter, influxes of Continental reed buntings can be seen feeding with other buntings and finches.

Many people hear but don't often see Cetti's warbler as it sings from the depths of tangled cover, often in reed with alder and understorey of bramble. Its song is a sudden loud burst of clear penetrating notes, which ends abruptly. Cetti's warbler numbers decline in severe winters, but in times of high population this bird will spread into young plantations and hedged fields away from water.





Case study Wildfowl refuge

An initiative has been set up to reduce disturbance to wintering waterfowl in the Upper Thurne. This has involved setting up refuges at key feeding and roosting locations in Hickling Broad and Heigham Sound, Martham Broads and Horsey Mere. The project involved allowing limited angling by permit within the refuges of Martham Broads and Horsey Mere. A Code of Practice was also promoted for the Hickling Broad refuges encouraging anglers to avoid the refuges if at all possible, to use electric outboards or oars, and if navigating within the refuges taking care to avoid birds.

Partnership

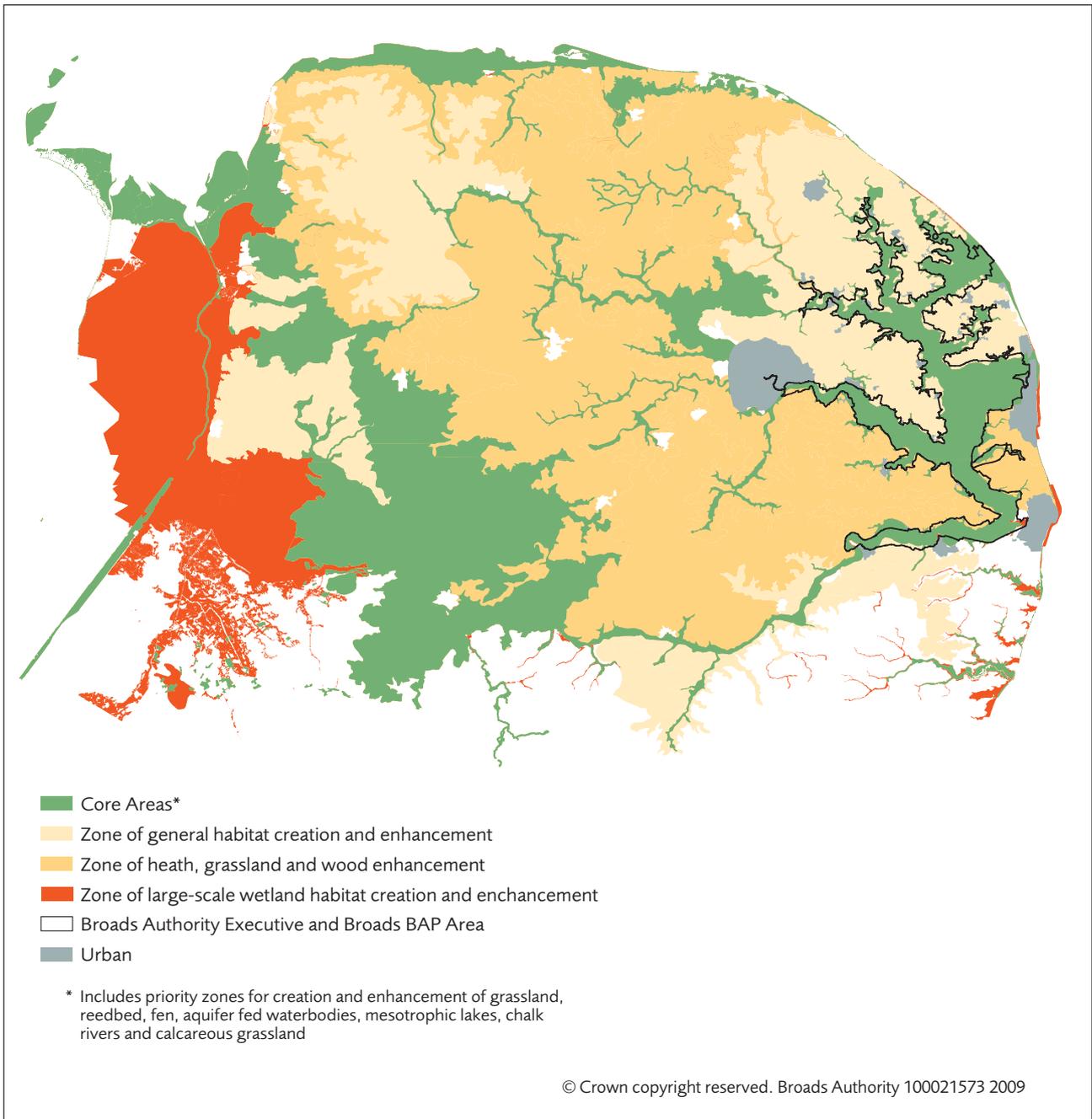
Angling community, Upper Thurne Working Group working with representatives of Natural England, Norfolk Wildlife Trust, National Trust and Horsey Estate.

Birds Special Challenges

- Develop a system of refuges for wintering waterfowl
- Manage the mosaic of Broadland wetland habitats for birds in conjunction with other biodiversity interest



Map 10 Ecosystem



5. Beyond the boundaries: **Ecological Networks**

The Broads ecosystem does not function alone as an island; it is connected by water and land to a wider catchment area in Norfolk and Suffolk. The longer term safeguarding of habitats and species in the Broads requires thinking and planning at a landscape scale, so that issues such as water supply and import of pollutants can be tackled and opportunities can be taken to re-connect and buffer habitats, enabling habitats to develop and species to disperse in response to changing conditions.

This approach is represented by developing ecological networks, which comprise four key elements:

- Core areas, which are clusters of high value wildlife sites
- Buffer areas which protect core areas from adverse impacts of adjacent land uses
- Enhancement areas where wildlife is currently impoverished, and there is a need to focus on habitat creation
- Corridors and stepping stones, which aim to connect areas of habitat and remove barriers to wildlife dispersal.

Developing ecological networks within the Broads Executive Area itself, aimed at expanding and linking areas of habitat as well as influencing land use beyond the boundaries of the Executive Area.

The ecological network maps for the East of England and for Norfolk both identify most of the Broads as a core wetland area, which means it is a priority area for the management and enhancement of existing resources, and for targeting the reversal of habitat fragmentation.

The tributary valley of the River Wensum SSSI/SAC is part of the core area of the Norfolk ecological network. As the main tributary of the River Yare, the River Wensum conveys not only water (with any chemical or sedimentary pollutants) but also floral and faunal species into the Broads system. The River Wensum catchment, especially its flood plain, should be considered as a buffer zone for the Broads.

Where the rivers are not constrained by flood defence banks, it is important to enhance the connections between the rivers and natural flood plain. This can take place where other issues are not constraining such as water quality and requirements for land drainage. In enabling rivers to use the natural flood plain, a more natural flood protection system could operate as flood storage with the land taking

water out of a flooded system. There can also be benefits for species with a flooded area providing fish with refuges from salt tides, additional habitat for eels, and bringing fish into smaller channel networks, particularly as food for bittern in reedbeds. This may also flush the wetland with base-rich water, which could be beneficial for aquatic plant populations.

Animals have a role in moving plant propagules to new areas, where sites are isolated by intensive land use. It is recognised that deer and birds carry out this function, and historically wild boar would also have played a role. In grazing marshes and dyke systems stock movements between sites can help maintain connectivity linking plant populations across a landscape.

Case study Valley-side connections

Hassingham Broad is designated as an SSSI and is particularly important for its stonewort-dominated aquatic plant community. The site is fed by water from Hassingham Beck, which is a highly channelled stream with little connectivity between its water flow and the adjacent fen. Sediment from arable land regularly finds its way via the beck into Hassingham Broad during high rainfall and as the groundwater is currently over nutrient-rich the favourable ecological status of the lake is under threat.

By installing a small weir in the beck sediment has begun to settle out of the water. Water quality has been further enhanced with two more drop-board weirs acting as sediment traps. Raising water levels in the adjacent fen field should also absorb some nutrients, reducing levels flowing in the beck water.

Partnership

This has been a landowner-led project delivered by the Broads Authority in partnership with Natural England and the Environment Agency advisors.

Ecological Networks Special Challenges

- Promote habitat management, restoration and contribution so that it contributes to the ecological network vision for Norfolk and Suffolk
- Develop partnership working to promote sensitive land use adjacent to the Broads and to reduce diffuse pollution

6. Recording and Researching the Natural Heritage

The Broads Authority has a long record of carrying out biodiversity monitoring work. A database of aquatic macrophytes monitoring goes back over 25 years providing a valuable baseline for much research and decision-making.

The Fen Management Strategy set out techniques for managing the fens which has been followed up with production of the Fen Audit. This analysed which land type was suited to different management techniques. Fen management monitoring has been more fragmentary and harder to co-ordinate as fens are managed under many different landownerships.

Other organisations within the Broads are responsible for carrying out monitoring work under their individual remits. Water quality monitoring is carried out by the Environment Agency, agri-environment schemes are covered by Natural England.

Natural England also carries out Common Standards Monitoring on all SSSIs to determine whether habitat is in favourable or unfavourable condition. This work contributes to understanding the effectiveness of management techniques, as well as delivering government indicators and targets.

Partnership working has enabled monitoring work on several Biodiversity Action Plan species. By pooling resources, projects collecting data and analysing findings have been developed. Many of these partnership monitoring projects are on-going, such as those covering bittern, water vole and otter. Smaller

scale surveys have been carried out on the Broads BAP snail species, and into the distribution of pillwort and greater water parsnip.

Storing and exchanging records

A wealth of information is being gathered by organisations and individuals and makes a valuable and essential contribution to the conservation of biodiversity. A mechanism for using the information to assess what is and is not being achieved is part of the biodiversity process. In 2001 a national system, accessible to all users, was set up to centralise an information database, becoming a fully web-based version from 2003.

This web based information system known as the Biodiversity Action Reporting System (BARS), supports the planning, monitoring and reporting requirements of national and local Biodiversity Action Plans (BAPs). It is also used for reporting on progress with UK BAPs. Key habitats and species in the Broads are reported to BARS by the Broads Authority and partner organisations.

Locally the Norfolk Biodiversity Information Service and Suffolk Biological Records Centre are taking a lead in collating data on BAP species, which will be used to monitor effectiveness of actions and develop further targets. The Broads Authority supports these services and will share and exchange data on a regular basis.



Surveying fen



Bittern

Indicator species and habitat monitoring

The UK government is committed to halting the decline in biodiversity, and it was agreed in 2001 by the European Union Heads of State or Governments that this objective should be reached by 2010. This was endorsed in 2002 where the Heads of State at the United Nations World Summit on Sustainable Development agreed to achieve a significant reduction of the current rate of biodiversity loss at the global, regional and national level.

There are 18 grouped indicators to be achieved which include the populations of selected species, extent of protected areas, river quality and expenditure on biodiversity protection. The indicators highlight those issues for which recent and longer term change has resulted in improvement or a worsening situation.

The Broads Authority contributes to the knowledge base about indicators through drawing up its State of the Park Review, which provides a baseline assessment of the current conditions of the Broads, focusing on the special qualities of the area. In addition, the Authority already produces a range of data through its own research and monitoring

programmes. Other data is sourced from partner organisations and from key research and monitoring agencies.

The biodiversity section within the State of the Park Review carries a list of indicators which will continue to report on the biodiversity condition of the Broads, namely:

- Percentage of Broads fens surveyed
- Number of booming bittern
- Number of waterbodies with holly-leaved naiad
- Number (and extent) of designated sites for nature conservation
- Percentage of SSSIs in favourable or recovering condition
- Percentage of SSSI units located predominantly on peat in favourable or recovering condition.

In addition to these indicators, the Action Plan sets out targets to maintain, enhance and create listed BAP habitats in the Broads. These targets link to existing county habitat action plans and require annual update as habitat restoration and creation programmes are delivered.

7. Mechanisms for Delivery

The Broads Authority approach to delivery of the Broads BAP is to ensure that staff working within the Authority on different aspects of managing the Broads are engaged with the Broads BAP.

Working with key partners is also essential for delivery of the Broads BAP. The Authority has many years experience in engaging others, drawing together key personnel to share expertise, and dissemination of knowledge and information.

The Broads Authority is well set up for communicating biodiversity information to others through its committee structure which involves members from a wide range of representative organisations. It has also developed a web site which directly connects with the National Parks and therefore with their Local BAPs. The Broads Authority has also been involved in the county Biodiversity Partnerships through membership of the main steering group and representation on topic groups, assisting with writing SAPs and HAPs and entering into discussion and debate. It is essential that these key biodiversity partners are involved in the delivery of the Broads BAP.

Partnerships

The Broads BAP presents a task of co-ordination, delivery and monitoring progress. The Broads Authority is proposing to form an internal Broads BAP group whose role will be to develop a five year implementation. The group membership will include

planning, landscape, recreation and conservation officers. Linking to the Broads Authority's Whole Valley Approach, this plan will be subject to an annual review and update in five years' time. The first essential step will be to work towards achieving the 2010 aim to halt the decline in biodiversity.

This internal group will be supported by a special annual meeting of the Norfolk Biodiversity Partnership's Wetland Topic Group and additional partners and experts to review progress and identify priorities for the future.

The wider community

Engaging people with the biodiversity process is fundamental to delivering the overall Action Plan. The most effective way of doing this is to engage at many levels.

As the lead organisation for this document the Broads Authority, through its various committees, makes contact with a wide range of organisations. Adoption of this Framework Document and the associated Action Plan by the Broads Authority and a commitment to delivery of key targets will make a huge contribution to the biodiversity future of the Broads.

The Broads BAP will also be incorporated into the reviewed Broads Plan due in 2009, and forms an important element of the Broads Local Development Framework.



Left and above: Engaging with people at 'Fun in the Broads' events



Engaging with professionals at the Coastal Catchments conference in Norwich

The Broads BAP will be further disseminated through the Broads Authority web site with the production of a brief informative leaflet. Visitors to the Broads will have access to information about biodiversity through visitor centres, and by having informed staff on the ground to speak to people passing on information and knowledge about biodiversity in the Broads.

Planning

As the planning authority for the Broads, the Broads Authority has responsibility for planning, conservation, development control and enforcement. The Authority is in the process of developing the Local Development Framework (LDF) for the Broads, and biodiversity is an integral part of delivery of this document.

The LDF is led by a Core Strategy, which was adopted in September 2007. This strategy contains a spatial vision with strategic objectives. Within this there is a core policy for the conservation, restoration and enhancement of important BAP habitats and species. Underneath the core strategy, the more detailed Development Management policies include a set of criteria to prevent adverse impacts on biodiversity.

The implementation of this policy will need to set out where improvements to the quality and extent of natural habitats will take place, as well as the physical processes on which they depend and the populations of naturally-occurring species that they support.

The impact of climate change on the distribution of biodiversity within the Broads is a key part of the LDF, and this will link into this Broads BAP.

The LDF must also be compatible with the national policy document Planning Policy Statement (PPS) 9 Biodiversity and Geological Conservation. The key principles within PPS 9 are that planning policies and decisions should not only avoid, mitigate or compensate for harm, but also seek ways to enhance and restore biodiversity and geology.

Planning applications made to the Broads Authority ensure that future development in the Broads contributes to the protection and enhancement of biodiversity. Applications are validated using guidance from the Association of Local Government Ecologists, which sets out the process for planners and those applying for planning permissions to assess the potential impact of applications on protected species and biodiversity, as well as the survey, mitigation and enhancement work that may be required.

8. Glossary

Bio-manipulation helps natural recovery of aquatic systems by switching turbid water to clear water. This technique involves temporary removal of selected fish species, in order to create the right conditions for zooplankton (e.g. water fleas *Daphnia* sp.) to feed on algae thereby clearing the water. Bio-manipulation is a management tool that often needs repeating. It is not the solution to long-term lake restoration, which relies on lower nutrient levels.

Alluvial is applied to environments, processes and products of rivers or streams.

Benthic zone is the lowermost region of a freshwater or marine profile where plants and animals are attached to or reside on the bottom sediments.

Broads Authority Executive Area The area of jurisdiction of the Broads Authority is designated by the Norfolk and Suffolk Broads Act 1988.

Ecological Impact Assessment is a key component of Environmental Impact Assessments (EIAs) carried out to provide decision makers with clear and concise information about the likely significant ecological effects associated with a project.

Environmentally Sensitive Areas In 1985, the Broads Authority pioneered the Broads Grazing Marshes Conservation Scheme, which offered landowners financial support to retain grass marshes as an alternative to incentives under the Common Agricultural Policy to turn these areas over to arable production. This scheme provided a prototype for the Broads Environmentally Sensitive Area scheme (ESA), which, combined with the production of water level management plans for the whole area, largely reversed the trend of agricultural intensification which took place throughout much of the previous three or four decades. It also prevented further damage to the grazing marshes by providing incentives for grassland management, higher water levels and reduced fertiliser usage. The simple options and payment system that operated within the ESA encouraged a high uptake of this voluntary scheme within the Broads grazing marshes.

European LIFE-funding is European funding for projects which support the implementation of EU environmental policy and legislation in respect of nature, biodiversity and other environmental issues.

Eutrophic is a term applied to nutrient-rich waters with high primary productivity.

Hard oligo-mesotrophic waters are waters with nutrient levels between intermediate and low, and with high levels of calcium carbonate (hard).

Hibernacula places where bats or other animals hibernate, or sleep, during the winter to conserve energy.

Hydroseral succession is a sequence of communities which represents the developmental stages in plant succession starting on a soil submerged in fresh water.

Landscape Character Units Landscape Units are discrete geographic areas of relatively uniform character which fall within particular tracts of countryside. These have a unity of character due to particular combinations of landform, land cover, and a consistent and distinct pattern of constituent elements.

Local Development Framework In September 2004 the Government introduced changes to the planning system for England under the Planning and Compulsory Purchase Act. Under the new system the Local Development Framework is replacing the Broads Local Plan and linked Supplementary Guidance. The LDF is made up of a number of Local Development Documents, which together set the policies and proposals for development and land use in the Broads. The new system is designed to be flexible to reflect changing circumstances and priorities. It will provide better opportunities for people to understand and be involved in development planning in their local area.

Mesotrophic is applied to waters or soils having levels of plant nutrients intermediate between eutrophic and oligotrophic.

National Vegetation Classification (NVC) is a system of classifying natural habitat types in Britain according to the vegetation they contain.

Natural eutrophic lakes are lakes which are naturally nutrient rich with high primary productivity. Although the Broads lakes are artificial, having arisen from peat digging in medieval times, these lakes and the ditches in areas of fen and drained marshlands support relict vegetation of the original Fenland flora.

Oligotrophic is applied to waters or soils that are poor in nutrients and with low primary productivity.

Poaching Trampling of vegetation, often in wet areas such as margins of watercourses

Propagules Vegetative portions of a plant, such as a bud or other offshoot, that aid in dispersal of the species and from which a new individual may develop

Transition mire A mire is a general term for a wetland area and its associated ecosystem applied most often to peaty areas. The term 'transition mire' relates to vegetation that in floristic composition and general ecological characteristics is transitional between an acid bog and alkaline fen.

Turf Ponds are shallow peat diggings dug during Victorian times. Some were dug to provide fuel, while others may have been cut as a way of clearing fen to improve the quality of the reed and sedge harvest. These turf ponds recolonise with rich diverse vegetation, and today the most species-rich areas in fens tend to be found where turf ponds were once dug.

9. References

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Web sites

For the Norfolk Biodiversity Partnership see <http://www.norfolkbiodiversity.org>

For the Suffolk Biodiversity Partnership see <http://www.suffolk.gov.uk>

Broads Authority see <http://www.broads-authority.gov.uk>



Wigeon

10. Appendix: Broads BAP Species List

This list is adapted from Norfolk Biodiversity Action Plan species Data Audit (draft) July 2007 produced by Norfolk Biodiversity Information Service.

| KEY TO STATUS CODES | | | |
|---------------------|-----------------------------------|----------|---|
| Group | Category | Code | Categories |
| All | Biodiversity Action Plan 2007 | BAP | <p><i>Threat</i> = International threat</p> <p><i>Resp_Threat</i> = International responsibility + moderate decline in UK</p> <p><i>Decl</i> = Marked decline in the UK</p> <p><i>Other</i> = Other important factor(s)</p> |
| All | Red Data Book | RDB | <p><i>Critically Endangered</i>: Facing an extremely high risk of extinction in the wild according to IUCN criteria.</p> <p><i>Endangered</i>: Facing a very high risk of extinction in the wild according to IUCN criteria.</p> <p><i>Vulnerable</i>: Facing a high risk of extinction in the wild according to IUCN criteria.</p> <p><i>Rare</i>: Taxa with small populations that are not at present Endangered or Vulnerable, but are at risk. (In GB, this was interpreted as species which exist in fifteen or fewer 10km squares).</p> <p><i>Lower risk - least concern</i>: Taxa which do not qualify for Lower Risk (conservation dependent) or Lower Risk (near threatened) or (in Britain) Nationally Scarce.</p> <p><i>Near Threatened</i>: Taxa which do not qualify for Lower Risk (conservation dependent), but which are close to qualifying for Vulnerable. In Britain, this category includes species which occur in 15 or fewer hectads but do not qualify as Critically Endangered, Endangered or Vulnerable.</p> |
| All | Wildlife and Countryside Act 1981 | WACA | <p>1.1: Birds, their nests and eggs, which are protected by special penalties at all times.</p> <p>9.1: Animals protected from intentional killing, injury or taking.</p> <p>9.2: Animals (alive, dead or parts of) protected from possession or controlling.</p> <p>9.4: Animals which are protected from (a) intentional damage or destruction to any structure or place used for shelter or protection, and (b) intentional disturbance while occupying a structure or place used for shelter or protection.</p> <p>9.5: Animals which are protected from (a) being sold, offered for sale or being held or transported for sale either live or dead, whole or part, and (b) Animals which are protected from being published or advertised as being for sale.</p> |
| All | EC Habitats Directive 1992 | HabDir | <p><i>Annex 2 (A2)</i>: Animal and plant species of community interest whose conservation requires the designation of Special Areas of Conservation.</p> <p><i>Annex 4 (A4)</i>: Animal and plant species of community interest in need of strict protection.</p> |
| Birds | EC Birds Directive 1992 | BirdsDir | <p><i>Annex 1 (A1)</i>: Species subject to special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution. Account shall be taken of (a) species in danger of extinction, (b) species vulnerable to specific changes in their habitat, (c) species considered rare because of small populations or restricted local distributions, and (d) other species requiring particular attention for reasons of the specific nature of their habitat.</p> <p><i>Annex 2 (A2)</i>: Species may be hunted under national legislation. Member States shall ensure that the hunting of these species does not jeopardize conservation efforts in their distribution area.</p> <p>(.1) Species may be hunted in the geographical sea and land area where this Directive applies.</p> <p>(.2) Species may be hunted only in the Member States in respect of which they are indicated.</p> |

| | | | |
|-------|--|----------|--|
| All | Bern Convention on the Conservation of European Wildlife and Natural Habitats 1979 | Bern | <i>Annex 2 (A2):</i> Special protection for the animal taxa listed, including: all forms of deliberate capture and keeping and deliberate killing; the deliberate damage to or destruction of breeding or resting sites; the deliberate disturbance of wild fauna, particularly during the period of breeding, rearing and hibernation, insofar as disturbance would be significant in relation to the objectives of this Convention; the deliberate destruction or taking of eggs from the wild or keeping these eggs even if empty; the possession of and internal trade in these animals, alive or dead, including stuffed animals and any readily recognisable part or derivative thereof, where this would contribute to the effectiveness of the provisions of this article. |
| All | Bonn Convention on the Conservation of Migratory Species of Wild Animals 1979 | Bonn | <i>Annex 1 (A1):</i> To conserve migratory species and their habitats by providing strict protection for endangered migratory species. <i>Annex 2 (A2):</i> The conservation and management of migratory species which require or would benefit from international cooperation. |
| All | Convention on International Trade in Endangered Species of Wild Fauna and Flora 1979 | ECCITES | <i>Annex A (A):</i> Species threatened with extinction and that are, or may be, affected by international trade. Some species that may become threatened with extinction unless trade is closely controlled by a permitting system. <i>Annex B (B):</i> Species that are not necessarily threatened with extinction but may become so unless trade is closely controlled by a permitting system. It also contains look-alike species, which are controlled because of their similarity to other regulated species, and species which are protected in at least one country and for which the co-operation of other Parties is needed to control international trade. |
| Birds | UK Bird Conservation Status | Bird | <i>Red:</i> Species that are globally threatened; have declined in population size in the UK during 1800 – 1995; have suffered rapid ($\geq 50\%$) contraction in UK breeding population and range over the last 25 years. <i>Amber:</i> Species that have suffered moderate (25-49%) declines in UK population breeding population and range over the last 25 years; have unfavourable conservation status in Europe; have a 5 year mean Of 1-300 breeding pairs in the UK; have $\geq 50\%$ of UK breeding population in 10 or fewer sites, but are not rare breeders; have $\geq 50\%$ of UK non-breeding population in 10 or fewer sites; have $\geq 20\%$ of European breeding population in UK; have $\geq 20\%$ of NW European (wildfowl), East Atlantic Flyway (waders) or European (others) non-breeding populations in UK. |
| Birds | EC Birds Directive 1992 | BirdsDir | <i>Annex 1 (A1):</i> Species subject to special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution. Account shall be taken of (a) species in danger of extinction, (b) species vulnerable to specific changes in their habitat, (c) species considered rare because of small populations or restricted local distributions, and (d) other species requiring particular attention for reasons of the specific nature of their habitat. <i>Annex 2 (A2):</i> Species may be hunted under national legislation. Member States shall ensure that the hunting of these species does not jeopardize conservation efforts in their distribution area. (.1) Species may be hunted in the geographical sea and land area where this Directive applies. (.2) Species may be hunted only in the Member States in respect of which they are indicated. |

| Species | Habitat | Where in the Broads | Status |
|---|--|---|--|
| MAMMALS | | | |
| European Hedgehog <i>Erinaceus europaeus</i> | General | Widespread | Common in the Broads BAP: Decl |
| Noctule Bat <i>Nyctalus noctula</i> | Woods, pasture and fens | Widespread | Not uncommon in The Broads BAP: Decl WACA: Sch5 – sect9.1, 9.2, 9.4a/b, 9.5a/b HabDir: A4 Bern: A2 Bonn: A2 |
| Soprano Pipistrelle Bat <i>Pipistrellus pygmaeus</i> | General | Widespread | Common in the Broads BAP: Decl, Other |
| Barbastelle Bat <i>Barbastella barbastellus</i> | Woodland | East Ruston Formerly Calthorpe | Rare in the Broads BAP: Threat, Other RDB: Vulnerable WACA: Sch5 – sect9.1, 9.2, 9.4a/b, 9.5a/b HabDir: A2, A4 Bern: A2 Bonn: A2 |
| Brown Long-eared Bat <i>Plecotus auritus</i> | Woodland | Widespread | Not uncommon in the Broads WACA: Sch5 – sect9.1, 9.2, 9.4a/b, 9.5a/b HabDir: A4 Bern: A2 Bonn: A2 |
| Brown Hare <i>Lepus europaeus</i> | Grazing marsh and farmland | Widespread | Localized in the Broads BAP: Other |
| Water Vole <i>Arvicola terrestris</i> | Waterway and fen | Widespread | Not uncommon in the Broads BAP: Decl, Other WACA: Sch5 - sect9.4a/b |
| Harvest Mouse <i>Micromys minutus</i> | Fen, reedbed, grazing marsh and farmland | Throughout the Norfolk and Suffolk Broads systems | Common in the Broads BAP: Decl, Other |
| Otter <i>Lutra lutra</i> | Waterways | Widespread | Common in the Broads BAP: Other WACA: Sch5 – sect9.1, 9.2, 9.4a/b, 9.5a/b HabDir: A2 Bern: A2 |
| BIRDS | | | |
| Bewick's Swan <i>Cygnus columbianus bewickii</i> | Grazing marsh | Yare, Thurne, Ant | Wintering in the Broads BAP: Threat WACA: Sch1.1 BirdsDir: A1 Bern: A2 Bonn: A2 Bird: Amber |

| Species | Habitat | Where in the Broads | Status |
|--|-----------------------|-----------------------|---|
| Grey Partridge <i>Perdix perdix perdix</i> | Farmland | Localised | Rare - declined in the Broads BAP: Decl, Other BirdsDir: A2.1 Bird: Red |
| Bittern <i>Botaurus stellaris stellaris</i> | Fen | Fen | Rare breeder and winter visitor in the Broads BAP: Other WACA: Sch1.1 BirdsDir: A 1 Bern: A2 Bird: Red |
| Lapwing <i>Vanellus vanellus</i> | Farmland and wetlands | Widespread | Scarce breeder, common winter visitor in the Broads BAP: Threat, Decl BirdsDir: A2.2 Bonn: A2 Bird: Amber |
| Black-tailed Godwit <i>Limosa limosa limosa</i> | Mudflats | Breydon and Hickling | Migrant in the Broads BAP: Threat WACA: Sch1.1 BirdsDir: A2.2 Bonn: A2 Bird: Red |
| Curlew <i>Numenius arquata arquata</i> | Mudflats | Breydon and Hickling | Passage migrant and winter in the Broads BAP: Resp_Threat BirdsDir: A2.2 Bonn: A2 Bird: Amber |
| Herring Gull <i>Larus argentatus argentatus</i> | General | Breeds Great Yarmouth | Scarce breeder, common winter in the Broads BAP: Resp_Threat BirdsDir: A2.2 Bird: Amber |
| Turtle Dove <i>Streptopelia turtur turtur</i> | Scrub | Very localised | Declining rapidly in the Broads BAP: Decl, Other BirdsDir: A2.2 ECCITES: A Bird: Red |
| Cuckoo <i>Cuculus canorus canorus</i> | General | Widespread | Declining in the Broads BAP: Decl |
| Nightjar <i>Caprimulgus europaeus europaeus</i> | Heathland | Winterton | Summer visitor in the Broads BAP: Other BirdsDir: A1 Bern: A2 Bird: Red |
| Lesser Spotted Woodpecker <i>Dendrocopos minor comminutus</i> | Carr and woodland | No current localities | Very rare/extinct in the Broads BAP: Threat, Resp_Threat, Decl Bern: A2 Bird: Red |
| S skylark <i>Alauda arvensis arvensis</i> | Farmland | Widespread | Resident and winter visitor in the Broads BAP: Decl, Other BirdsDir: A2.2 Bird: Red |

| Species | Habitat | Where in the Broads | Status |
|---|-------------------------------|---------------------|---|
| Yellow Wagtail <i>Motacilla flava flavissima</i> | Grazing marsh | Localised | Passage and rare declining breeder in the Broads BAP: Resp_Threat Bern: A2 Bird: Amber |
| Dunnock <i>Prunella modularis occidentalis</i> | General | Widespread | Common resident in the Broads BAP: Resp_Threat Bern: A2 Bird: Amber |
| Song Thrush <i>Turdus philomelos clarkei</i> | General | Widespread | Resident and winter in the Broads BAP: Resp_Threat, Other BirdsDir: A2.2 Bird: Red |
| Grasshopper Warbler <i>Locustella naevia naevia</i> | Fen breeder | Localised | Summer breeder in the Broads BAP: Decl Bird: Red |
| Savi's Warbler <i>Locustella luscinioides luscinioides</i> | Fen breeder | Chiefly Thurne | Very rare summer visitor in the Broads BAP: Decl WACA: Sch1.1 Bird: Red |
| Marsh Warbler <i>Acrocephalus palustris</i> | Fen breeder | Localised | Rare summer breeder in the Broads BAP: Decl, Other WACA: Sch 1.1 Bird: Red |
| Spotted Flycatcher <i>Muscicapa striata striata</i> | Woodland | Localised | Rare breeder in the Broads BAP: Decl, Other Bern: A2 Bonn: A2 Bird: Red |
| Willow Tit <i>Poecile montana kleinschmidti</i> | Carr and woodland | Extinct | Extinct in the Broads BAP: Threat, Resp_Threat Bern: A2 Bird: Red |
| Marsh Tit <i>Poecile palustris palustris/ dresseri</i> | Carr and woodland | Widespread | Common breeder in The Broads BAP: not specified Bern: A2 Bird: Red |
| Starling <i>Sturnus vulgaris vulgaris</i> | General. Roost in reedbeds | Widespread | Resident and winter visitor in The Broads BAP: Decl BirdsDir: A2.2 Bird: Red |
| House Sparrow <i>Passer domesticus domesticus</i> | Farms and habitation | Localised | Declining resident in The Broads BAP: Decl Bird: Red |
| Tree Sparrow <i>Passer montanus montanus</i> | Farmland | Game strips | Former breeder, now rare winter visitor in The Broads BAP: Decl, Other Bird: Red |

| Species | Habitat | Where in the Broads | Status |
|--|----------------------|----------------------------|---|
| Linnet <i>Carduelis cannabina</i> <i>autochthona/cannabina</i> | Coast and heathland | Chiefly coastal | Scarce breeder and declining passage in The Broads BAP: Other Bern: A2 Bird: Red |
| Bullfinch <i>Pyrrhula pyrrhula pileata</i> | Scrub and woodland | Localised | Resident in The Broads BAP: Resp_Threat, Other Bird: Red |
| Yellowhammer <i>Emberiza citrinella citrinella</i> | Farmland | Localised | Passage and rare declining breeder in the Broads BAP: Resp_Threat Bern: A2 Bird: Amber |
| Reed Bunting <i>Emberiza schoeniclus schoeniclus</i> | Fen breeder | Widespread | Resident and winter visitor in The Broads BAP: Other Bern: A2 Bird: Red |
| FRESHWATER FISH | | | |
| European Eel <i>Anguilla anguilla</i> | Rivers, lakes, dykes | Widespread | Common in The Broads BAP: Resp_Threat, Other |
| AMPHIBIANS | | | |
| Great Crested Newt <i>Triturus cristatus</i> | Ponds | Winterton | Very rare in The Broads BAP: Other WACA: Sch5 – sect9.1, 9.2, 9.4a/b, 9.5a/b HabDir: A2,A4 Bern: A2 |
| Common Toad <i>Bufo bufo</i> | General | Widespread | Common in The Broads BAP: Other WACA: Sch5 – sect9.5a/b |
| Natterjack Toad <i>Epidalea calamita</i> | Dune slacks | Winterton and Horsey | Rare in The Broads BAP: Other WACA: Sch5 – sect9.1, 9.2, 9.4a/b, 9.5a/b HabDir: A4 Bern: A2 |
| REPTILES | | | |
| Grass Snake <i>Natrix natrix</i> | Wetland | Widespread | Common in The Broads BAP: Other WACA: Sch5 – sect9.1, 9.5a/b |
| Adder <i>Vipera berus</i> | Dunes and heathland | Localised, chiefly coastal | Scarce in The Broads BAP: Other WACA: Sch5 – sect9.1, 9.5a/b |
| Common Lizard <i>Zootoca vivipara</i> | General | Localised | Scattered colonies in The Broads BAP: Other WACA: Sch5 – sect9.1, 9.5a/b |
| Slow-worm | General | Widespread | Common in The Broads BAP: Other WACA: Sch5 – sect9.1, 9.5a/b |

| Species | Habitat | Where in the Broads | Status |
|---|---|---|--|
| DRAGONFLIES | | | |
| Norfolk Hawker <i>Aeshna isosceles</i> | Grazing marsh | Throughout | Common in The Broads BAP: Other RDB: Endangered WACA: Sch5 – sect9.1, 9.2, 9.4a/b, 9.5a/b |
| WATER BUGS | | | |
| Lesser Water Measurer <i>Hydrometra gracilentia</i> | Fen | Barton Broad (1950 – 1960), Sutton Broad (1950 – 1960), and Reedham Marsh (1989), possibly throughout | Probably common in The Broads – under recorded BAP: Other RDB: Nationally Rare |
| BEEES, WASPS AND ANTS | | | |
| Fen Mason-wasp <i>Odynerus simillimus</i> | Coastal grazing marsh and fens (vertical banks) | Hickling | Very rare in The Broads BAP: Other RDB: Endangered |
| TERRESTRIAL AND FRESHWATER BEETLES | | | |
| One-grooved Diving Beetle <i>Bidessus unistriatus</i> | Fen | Catfield | Rare in The Broads BAP: Other RDB: Endangered |
| Stag Beetle <i>Lucanus cervus</i> | Gardens, wooded parks and woodland | No confirmed Norfolk records | Unconfirmed reports from Norwich and Broads all probably refer to lesser stag beetle which is common BAP: Other WACA: Sch 5 – sect9.5a/b HabDir: A2 Notable: B |
| Zircon Reed Beetle <i>Donacia aquatica</i> | Fen | Throughout | Common in The Broads BAP: Other RDB: Nationally Rare |
| Sallow Guest Weevil <i>Melanapion minimum</i> | Woodland and carr besides water features | Widespread | Widespread and locally common in The Broads BAP: Other Notable: B RDB: Nationally Rare |
| BUTTERFLIES | | | |
| Swallowtail <i>Papilio machaon</i> | Fen | Thurne, Ant, Bure and Yare | Common in The Broads WACA: Sch 5 – sect9.1, 9.2, 9.4a/b, 9.5a/b RDB: Vulnerable |
| White-letter Hairstreak Butterfly <i>Satyrrium w-album</i> | Elm hedgerows | Very local | Rare in The Broads BAP: Decl WACA: Sch5 – sect9.5a/b |
| White Admiral Butterfly <i>Limnitis camilla</i> | Woodland | Widespread | Fairly common in The Broads BAP: Decl |

| Species | Habitat | Where in the Broads | Status |
|---|------------------------------|---|---|
| Wall Butterfly <i>Lasiommata megera</i> | Open grassland | Widespread | Scarce and localised in The Broads BAP: Decl |
| Grayling Butterfly <i>Hipparchia semele</i> | Open grassland | Winterton and Horsey | Common in limited area in The Broads BAP: Decl |
| Small Heath Butterfly <i>Coenonympha pamphilus</i> | Open grassland and heathland | Sites throughout the Yare, Bure, Thurne valleys and a few sites in the Ant valley | Common in The Broads BAP: Decl |
| MOTHS | | | |
| Ghost Moth <i>Hepialus humuli</i> | Grassland | Widespread | Common in The Broads BAP: Decl |
| The Forester <i>Adscita statices</i> | Heathland | Coastal and heathland | Scarce in The Broads BAP: Decl |
| The Lackey <i>Malacosoma neustria</i> | General | Widespread | Common in The Broads BAP: Decl |
| Oak Hook-tip <i>Watsonalla binaria</i> | Woodland | Widespread | Common in The Broads BAP: Decl |
| Blood-vein <i>Timandra comae</i> | General | Widespread | Common in The Broads BAP: Decl |
| Bright Wave <i>Idaea ochrata</i> | Fen and coastal | River Bure, near Runham (2004) | Very rare in The Broads BAP: Other RDB: Nationally Rare |
| Oblique Carpet <i>Orthonama vittata</i> | Fen | Local | Locally common in The Broads BAP: Decl |
| Dark-barred Twin-spot Carpet <i>Xanthorhoe ferrugata</i> | General | Widespread | Common in The Broads BAP: Decl |
| Shaded Broad-bar <i>Scotopteryx chenopodiata</i> | Grasslands | Widespread | Locally common in The Broads BAP: Decl |
| The Spinach <i>Eulithis mellinata</i> | Carr and gardens | Widespread | Scarce in The Broads BAP: Decl |
| Small Phoenix <i>Ecliptopera silaceata</i> | General | Widespread | Common in The Broads BAP: Decl |
| The Streak <i>Chesias legatella</i> | Open grasslands and heaths | Local | Scarce in The Broads BAP: Decl |
| Broom-tip <i>Chesias rufata</i> | Open grasslands and heaths | Local | Scarce in The Broads BAP: Decl |
| August Thorn <i>Ennomos quercinaria</i> | Woodland | Widespread | Rare in The Broads BAP: Decl |
| Dusky Thorn <i>Ennomos fuscantaria</i> | Woodland | Widespread | Uncommon in The Broads BAP: Decl |
| September Thorn <i>Ennomos erosaria</i> | General | Widespread | Uncommon in The Broads BAP: Decl |

| Species | Habitat | Where in the Broads | Status |
|--|---------------------------|----------------------|---|
| Brindled Beauty <i>Lycia hirtaria</i> | General | Widespread | Uncommon in The Broads BAP: Decl |
| Grayling Butterfly <i>Hipparchia semele</i> | Open grassland | Winterton and Horsey | Common in limited area in The Broads BAP: Decl |
| Figure of Eight <i>Diloba caeruleocephala</i> | Woods and hedges | Widespread | Scarce in The Broads BAP: Decl |
| Scarce Vapourer <i>Orgyia recens</i> | Fen margins | Very local | Rare in The Broads BAP: Decl RDB: Vulnerable |
| White Ermine <i>Spilosoma lubricipeda</i> | General | Widespread | Common in The Broads BAP: Decl |
| Buff Ermine <i>Spilosoma luteum</i> | General | Widespread | Common in The Broads BAP: Decl |
| The Cinnabar <i>Tyria jacobaeae</i> | Pasture and grassland | Widespread | Common in The Broads BAP: Decl |
| Garden Dart <i>Euxoa nigricans</i> | General | Local | Scarce in The Broads BAP: Decl |
| Small Square-spot <i>Diarsia rubi</i> | General | Widespread | Common in The Broads BAP: Decl |
| Heath Rustic <i>Xestia agathina</i> | Coastal | Heathland | Locally common in The Broads BAP: Decl |
| Broom Moth <i>Melanchra pisi</i> | General | Local | Scarce in The Broads BAP: Decl |
| Powdered Quaker <i>Orthosia gracilis</i> | Grassy areas | Widespread | Common in The Broads BAP: Decl |
| Minor Shoulder-knot <i>Brachylomia viminalis</i> | Woodland and fens | Very local | Common in The Broads BAP: Decl |
| The Sprawler <i>Asteroscopus sphinx</i> | Wood and scrub | Widespread | Rare in The Broads (probably under-recorded as it is a winter flyer) BAP: Decl |
| Green-brindled Crescent <i>Allophytes oxyacanthae</i> | General | Widespread | Common in The Broads BAP: Decl Notable: B |
| Brown-spot Pinion <i>Agrochola litura</i> | General | Widespread | Common in The Broads BAP: Decl |
| Beaded Chestnut <i>Agrochola lychnidis</i> | General | Widespread | Common in The Broads BAP: Decl |
| Centre-barred Sallow <i>Atethmia centrago</i> | Woods and hedges with ash | Widespread | Common in The Broads BAP: Decl |
| The Sallow <i>Xanthia icteritia</i> | General | Widespread | Common in The Broads BAP: Decl |
| Dusky Lemon Sallow <i>Xanthia gilvago</i> | Elm woods | Very local | Very rare in The Broads BAP: Decl |
| Grey Dagger <i>Acronicta psi</i> | General | Widespread | Common in The Broads BAP: Decl |

| Species | Habitat | Where in the Broads | Status |
|--|--|---|---|
| Knot Grass <i>Acronicta rumicis</i> | General | Local | Scarce in The Broads BAP: Decl |
| Mouse Moth <i>Amphipyra tragopoginis</i> | General | Widespread | Common in The Broads BAP: Decl Notable: A |
| Large Nutmeg <i>Apamea anceps</i> | Grassy places | Chiefly coastal | Scarce in The Broads BAP: Decl |
| Rosy Minor <i>Mesoligia literosa</i> | Grassy places | Widespread | Common in The Broads BAP: Decl |
| Fenn's Wainscot <i>Chortodes brevilinea</i> (Broads speciality) | Fen | River valleys | Locally common in The Broads BAP: Other RDB: Nationally Rare |
| Ear Moth <i>Amphipoea oculea</i> | Grassland | Local | Scarce in The Broads BAP: Decl |
| Rosy Rustic <i>Hydraecia micacea</i> | Open areas | Widespread | Common in The Broads BAP: Decl |
| Haworth's Minor <i>Celaena haworthii</i> (on Cotton Grass) | Fen | Local | Scarce and probably declining in The Broads BAP: Decl |
| The Crescent <i>Celaena leucostigma</i> | Fen and carr | Widespread | Common in The Broads BAP: Decl |
| The Rustic <i>Hoplodrina blanda</i> | Gardens and open areas | Widespread | Common in The Broads BAP: Decl |
| Mottled Rustic <i>Caradrina morpheus</i> | General | Widespread | Common in The Broads BAP: Decl |
| Marsh Moth <i>Athetis pallustris</i> | Fen and coastal | Sportsman's Staithe, Ormesby | Very rare in The Broads BAP: Decl, Other RDB: Nationally Rare |
| Water-dock Case-bearer <i>Coleophora hydrolapathella</i> (Broads speciality) | Fen | Widespread | Locally common in The Broads BAP: Decl, Other |
| FLIES | | | |
| Black Fungus Gnat <i>Asindulum nigrum</i> | Open wetland habitats (floodplain grazing marsh, fens) | Marshes near Aldeby Hall (1928), Barton Broad (1988), Woodbastwick (1989) | Very rare in The Broads BAP: Resp_Threat RDB: Near Threatened |
| Broads Long-legged Fly <i>Dolichopus laticola</i> | Fen and wet woodlands | 4 fen areas in Norfolk Broads | Rare in The Broads BAP: Resp_Threat RDB: Endangered |
| Clubbed Big-headed Fly <i>Dorylomorpha clavifemora</i> | Reedbeds | Hickling 1990 | Very rare in The Broads BAP: Resp_Threat RDB: Vulnerable |
| SPIDERS | | | |
| Sand Running-spider <i>Philodromus fallax</i> | Coastal | Winterton | Very rare in The Broads BAP: Decl |

| Species | Habitat | Where in the Broads | Status |
|---|---|--|--|
| Sedge Jumper <i>Sitticus caricis</i> | Fen | Catfield Fens (2006), Reedham Marsh (1971), & Sutton Broad (1971) | Very rare in The Broads BAP: Decl |
| TERRESTRIAL AND FRESHWATER MOLLUSCS | | | |
| Large-mouthed Valve Snail <i>Valvata macrostoma</i> | River and marsh dykes | A few sites within the Bure, Yare and Chet valleys | Rare in The Broads BAP: Threat, Other RDB: Vulnerable |
| Shining Ram's-horn Snail <i>Segmentina nitida</i> | Grazing marsh dykes and ponds | Yare, Waveney, & some broads | Rare in The Broads BAP: Other RDB: Endangered HabDir: A2 |
| Little Whirlpool Ram's-horn Snail <i>Anisus vorticulus</i> | Grazing marsh dykes | 5 sites in the Yare valley and 6 sites in the Waveney valley | Rare in The Broads BAP: Threat, Resp_Threat, Decl, Other RDB: Vulnerable HabDir: A2, A4 |
| Swollen Spire Snail <i>Mercuria confusa</i> | Soft mud banks, fresh or slightly brackish waters | Mid-Yare & Waveney Rivers, linked broads and dykes | Rare in The Broads BAP: Other RDB: Endangered HabDir: A2 |
| Depressed River Mussel <i>Pseudanodonta complanata</i> | River | Yare & Waveney, particularly abundant near Beccles | Rare in The Broads BAP: Other |
| Narrow-mouthed Whorl Snail <i>Vertigo angustior</i> | Wetland habitats | 9 sites in Norfolk | Rare in The Broads BAP: Threat, Decl, Other RDB: Endangered HabDir: A2 |
| Desmoulin's Whorl Snail <i>Vertigo moulinsiana</i> | Fen and marshes bordering rivers, lakes | Yare, Ant & Bure valleys, particularly Trinity Broads & Burgh Common | Locally common in The Broads BAP: Threat, Other RDB: Nationally Rare HabDir: A2 |
| BRYOZOAN | | | |
| Crystal Moss-animal <i>Lophopus crystallinus</i> | Freshwater lakes, ponds, ditches, and slow rivers | Eastern end of Fritton Lake (1933), Brandeston Marsh / Strumpshaw Fen area | Very rare in The Broads BAP: Decl, Other RDB: Nationally Rare |
| FUNGI AND LOWER PLANTS | | | |
| Bearded Tooth Fungus <i>Hericium erinaceus</i> | Old woodland | Whitlingham | Very rare in The Broads BAP: Threat RDB: Endangered WACA: Sch8 |

| Species | Habitat | Where in the Broads | Status |
|--|---------------------------------------|--|---|
| Velvet Tooth Fungus <i>Hydnellum spongiosipes</i> | Broadleaved woodland | Yare valley | Very rare in The Broads BAP: Other RDB: Vulnerable |
| Fused Tooth Fungus <i>Phellodon confluens</i> | Broadleaved woodland | Yare valley | Very rare in The Broads BAP: Other RDB: Vulnerable |
| STONEWORKTS | | | |
| Baltic Stonewort <i>Chara baltica</i> | Lake | Upper Thurne | BAP: Other RDB: Vulnerable |
| Bearded Stonewort <i>Chara canescens</i> | Lake | Not found since 1965, Upper Thurne | BAP: Other RDB: Endangered (extinct from the Broads) WACA: Sch8 |
| Convergent Stonewort <i>Chara connivens</i> | Lake | Upper Thurne | BAP: Other RDB: Endangered |
| Intermediate Stonewort <i>Chara intermedia</i> | Lake | Upper Thurne | BAP: Other RDB: Endangered |
| Starry Stonewort <i>Nitellopsis obtusa</i> | Lake | Upper Thurne | BAP: Other RDB: Vulnerable |
| Tassel Stonewort <i>Tolypella intricata</i> | Fen and grazing marsh dykes | Cantley Marshes, and, historically, Gillingham Marshes | BAP: Other RDB: Endangered |
| Great Tassel Stonewort <i>Tolypella prolifera</i> | Fen and grazing marsh dykes | Cess, near Martham | BAP: Other RDB: Endangered |
| VASCULAR PLANTS | | | |
| Pillwort <i>Pillularia globulifera</i> | Sandy water margins | Lound | Population highly variable in The Broads |
| Crested Buckler-fern <i>Dryopteris cristata</i> | Fen | Chiefly Ant Valley | Locally common in The Broads BAP: Decline RDB: Critically Endangered Nationally Rare |
| Prickly Saltwort <i>Salsola kali kali</i> | Tideline | Coastal | Rare in The Broads BAP: Other RDB: Vulnerable |
| Marsh Stitchwort <i>Stellaria palustris</i> | Marshes and fens | Widespread | Common in The Broads BAP: Other RDB: Vulnerable |
| Tubular Water-dropwort <i>Oenanthe fistulosa</i> | Marshes, ditches and other wet places | Widespread | Common in The Broads BAP: Other RDB: Vulnerable |
| Slender Hare's-ear <i>Bupleurum tenuissimum</i> | Sea banks | Breydon | Very localised in The Broads BAP: Other RDB: Vulnerable |

| Species | Habitat | Where in the Broads | Status |
|--|-------------------------------|-------------------------------------|---|
| Greater Water-parsnip <i>Sium latifolium</i> | Fen | Widespread but chiefly Bure and Ant | Scarce in The Broads BAP: Decline, Other RDB: Endangered Nationally Scarce |
| Crested Cow-wheat <i>Melampyrum cristatum</i> | Wood borders and scrub | Near Beetly | Very rare in The Broads BAP: Other RDB: Vulnerable Nationally Rare |
| Floating Water-plantain <i>Luronium natans</i> | Grazing marsh dyke | Potter Heigham marshes | Introduced in The Broads BAP: Other RDB: Lower risk – least concern WACA: Sch8 HabDir: A2, A4 Bern: A1 Nationally Rare |
| Sharp-leaved Pondweed <i>Potamogeton acutifolius</i> | Ponds, canals, and streams, | Yare valley | Rare in The Broads BAP: Decl RDB: Critically Endangered Nationally Rare |
| Grass-wrack Pondweed <i>Potamogeton compressus</i> | Grazing marsh dyke | Very rare – only recently Upton | Very rare in The Broads BAP: Other RDB: Endangered Nationally Rare |
| Holly-leaved Naiad <i>Najas marina</i> | Broads | Localised | Population highly variable in The Broads BAP: Other RDB: Vulnerable WACA: Sch8 Nationally Rare |
| Divided Sedge <i>Carex divisa</i> | Marshes, pastures and ditches | | Rare in The Broads BAP: Other RDB: Vulnerable Nationally Scarce |
| Borrer's Saltmarsh-grass <i>Puccinellia fasciculata</i> | Saltmarsh | Breydon | Very rare in The Broads BAP: Other RDB: Vulnerable Nationally Rare |
| Fen Orchid <i>Liparis loselii</i> | Fen | Ant and Bure | Four localities in The Broads BAP: Other RDB: Endangered WACA: Sch8 HabDir: A2, A4 Bern: A1 ECCITES: B Nationally Rare |



Bee orchid

Credits

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