DISCOVER

It's our nature!

For most of human history our lives have been shaped by the local landscape: our survival depended on knowing it well. Knowledge of the wildlife and the habitats around us was second nature when most of us worked on the land and walked to our work places. Today you might think we no longer need nature but the more you think about your connections with nature – and we hope this guide will inspire you to think about them – the more you see them everywhere. What's the paper in this book made from? What are you breathing, without even noticing, while you read this?

What's more nature makes us feel good. Close your eyes and think of somewhere really beautiful. The chances are your beautiful place was outdoors. Perhaps there was a river nearby (water makes us feel really good), maybe the sun was shining through the fresh leaves of a tree, and there's a good chance birds were singing in the background or a butterfly was chasing around.

The DISCOVER section of this guide introduces you to some of the important habitats that are found in the Bure Valley Living Landscape and tells you about the wildlife you can discover here.

Do I really need healthy ecosystems and a wildlife rich landscape?

Even if you are sitting indoors while you read this, the life-giving oxygen in the next breath you take will have been provided by green plants and the carbon dioxide you breathe out will be taken from the air by those same green plants. This is a big part of what regulates our climate and makes it habitable, and it's done all the time, for nothing, and with nobody noticing, by nature. It's what we call an ecosystem service. The balance of gases in our atmosphere is maintained by living creatures, in their habitats, functioning in ecosystems.

It's happening all around you! Natural habitats in the Bure and Ant valleys and the wild species that live in them help reduce man-made climate change: the peat-forming marshes in the Broads take carbon dioxide from the atmosphere and lock it away in buried layers of wet peat. Trees in the woods, parks, gardens and streets of our Bure and Ant valleys also lock away atmospheric carbon in their timber.

And what did you eat for breakfast? Many of our food crops still depend on wild bees and other wild insects to pollinate them and of course all of our food plants depend on the ecosystems that maintain healthy soils. Much of the land in the Bure and Ant valleys is farmland. All of this farmland, whether producing crops or livestock, depends on supplies of fresh water. The wetland habitats in the Bure and Ant valleys help prevent flooding after heavy rains and hold water like sponges when it's plentiful, releasing it slowly during the summer months and helping make sure the rivers don't run dry. Nature's doing all this, and much, much more, all the time, and for nothing!

We may take it for granted, but the natural beauty of our local landscape – its woods, grazing marshes, broads, dykes and green spaces – helps keep us happy, healthy and sane! Scientists call this function of the landscape a cultural service. From the first cave paintings to 21st century art, nature has been the single greatest source of human inspiration. So read on: we hope this guide to the Bure Valley Living Landscape will inspire you. This Living Landscape is a source of food, clean water, clean air, healthy soils, amazing wildlife and stunning natural beauty. If you live in it or visit it, you are part of it and it in turn plays a huge part in your quality of life.

Discover the **Bure Valley**
Explore **A Living Landscape**

Water connects this landscape: standing water, flowing water, water falling as rain and water in the ground. Water casts its spell over this landscape. Both people and wildlife are drawn to water and the wetland habitats it supports. Here you will find the open waters of the Broads, the hidden watery worlds of dykes criss-crossing cattle-grazed marshes and dark, mysterious woodland pools within primeval-looking carr woodlands. Linking these varied wetlands are parts of three rivers, the Bure, Ant and Thurne. Key to the health of this Living Landscape is the quality and quantity of its waters. Something that all who live, works or visit here can influence.

NWT Barton Broad p44

NWT Alderfen Broad p51

St Benet's Abbey p53

How Hill

Hoveton Little Broad

Wroxham Broad

Wroxham

River Bure

River Ant

Hoveton Great Broad

Salhouse Broad

South Walsham Broad

River Thurne

River Bure

Acle

N

NWT Cockshoot Broad p47

NWT Ranworth Broad p43

NWT Upton Broad and Marshes p48

Trinity Broads p54

A lustrous blue line was drawn against the dark forest of trunks as a kingfisher sped down-river.

Henry Williamson

Tarka the Otter

The Rivers Bure and Ant

Without the Rivers Bure and Ant there would be no Living Landscape. They gather and guide the water which makes this a wetland, they connect habitat with habitat, and human community with human community. Rivers are the connective tissue of the Bure Valley Living Landscape.

Every significant habitat in the Bure and Ant valleys – grazing marsh, fen, reedbed, carr wood – can be found along rivers and is directly influenced by them. Most human settlements are by them too, reflecting the landscape's history of transport and resource use. Migrating birds – gulls, terns, sandpipers, even ospreys – follow them; water voles, otters, perch and pike live in them; people sail on them, birdwatch and fish along them, paint them and seek solace by them.

These two rivers define the landscape. Then, gathering the Thurne, they slip into Breydon Water where, together with the Yare, the Wensum and the Waveney, they gift two thirds of Norfolk's water to the sea. Rivers, in a word, are what make this Living Landscape live.

kingfisher

How were they formed?

The landscape of Norfolk – its coastline, its topography, the distribution of its soils – has its roots in the Ice Age. With the retreat of the Devensian Glaciation, some 12,000 years ago, Norfolk's gently undulating landscape of glacial deposits was left exposed. It is by these glacial moraines that Norfolk's river catchments, notably the Bure and the Ant, are framed. The Bure is in origin a North Norfolk river. Its fan of tributaries flows off the south side of the glacial Holt-Cromer Ridge and from the south of the North Norfolk Woods Living Landscape. It is pushed towards Broadland by an ice sheet's rubble pile, which in Norfolk is enough to count as a watershed. Similarly, the Ant is hemmed in, and kept from flowing to sea, by the line of Ice Age sea-cliffs to its east, which form the Norfolk coastline from Weybourne to Happisburgh.

In their lower reaches these two rivers wander, without apparent purpose, through the relentlessly flat landscape of Broadland. They throw lazy loops through fen and grazing marsh, and trudge muddily towards Breydon and the North Sea.

How have people used them?

The history of human settlement in Broadland is a history of rivers. Prior to the drainage of the Broadland landscape, with dykes, windmills and modern pumps, large parts of the region would have been flooded for much of the year, rendering roads and transport by horses or carts difficult. For centuries, rivers were Broadland people's main thoroughfares and were used for transporting natural materials, such as reed, peat and pelts, which had been gathered in the surrounding landscape. The rivers were used too as sources of natural resources, being fished, and hunted for waterfowl and mammals.

In recent centuries, rivers have been more actively managed by people. They are used to take away water pumped from surrounding fields, embanked to prevent them flooding these same fields and their villages, and dredged to keep them on their existing courses. They have also become the highways for a thriving tourist industry based largely on boating and fishing.

water vole

great crested grebe

What special wildlife lives here?

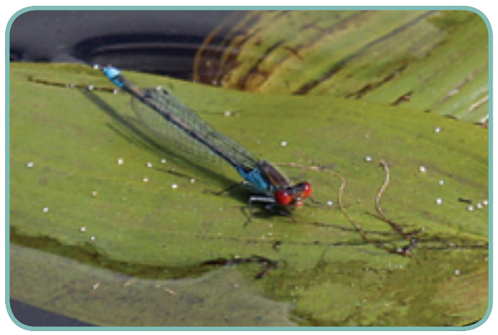
A boat trip along the Bure or the Ant in early summer is an assault on the eyes and ears. From the fringe of reed at the river's edge come the stolid chuntering of a reed warbler and the florid pizzicato of a Cetti's warbler. A burnished kingfisher whistles past and lands in a sallow tumbling to the water's surface. From the rubbery pads of the yellow water lilies which line the banks red-eyed damselflies flit, and in their shade a saw-jawed pike holds perfectly still. Above a squadron of common terns, slow-flapping their continent-crossing wings in display, a pair of swallows alarm calls at a hobby in the hazy distance.

Take the same journey in winter and what you see will be quite different. Tufted ducks and pochard crowd in a dense flock where a dredger has passed, exposing food on the river bed. Two grey herons are sulkily hunched on posts at the water's edge. Suddenly the black-headed gulls, their black heads reduced by winter to a charcoal smudge on their cheeks, begin to dive-bomb a ripple which is moving through the twisted alder roots. A square brown snout leads the ripples: an otter, perhaps your first! He works the riverbank, searching for prey, but, surrendering to the bullying gulls, he dives, leaving only a trail of bubbles on the water's surface.

DISCOVER – RIVERS

NWT Cockshoot Broad
NWT Ranworth Broad
How Hill NNR • St Benet's Abbey
NWT Upton Broad and Marshes
Wroxham

tufted duck



red-eyed damselfly

These are just a few of the species you could see along the Bure and Ant rivers:

yellow water lily
lesser bulrush
yellow flag iris
common reed
alder
common sallow

red-eyed damselfly
common blue damselfly

great crested grebe
tufted duck
pochard
grey heron
kingfisher
common tern
swallow
greylag goose
Egyptian goose

otter
water vole
Daubenton's bat
soprano pipistrelle bat
European eel
gudgeon

What conservation challenges are there?

The development of modern towns, agriculture and tourism in Broadland and beyond led to some of the greatest threats to its rivers. With the use of nitrate fertilisers, and the careless disposal of effluent, the rivers of Broadland became increasingly burdened with nutrients. The rivers' banks were damaged too by the wash from speeding boat traffic and the burrows of fur-farm coypus which had escaped and flourished. The coypus have gone now and boat speed and emissions are better controlled, but the pristine rivers of Broadland, including the Bure and the Ant, have changed greatly in the Twentieth Century. The challenge facing us now, as stake holders in the Living Landscape, is to help their lower reaches return to the health they once enjoyed.

Two further threats to rivers and to the whole Broadland landscape are sea level rise, engendered by climate change, and the increased occurrence of storm surges and saltwater floods. Throughout recorded history, Broadland has changed several times from a freshwater wetland to a saltwater wetland. Among the greatest, but least controllable, threats to what we perceive as its modern wildlife value are increased salinity and inundation by the sea.

Return of the native

By the 1970s the otter had all but disappeared from England, poisoned by agricultural pesticides. In East Anglia its decline was especially drastic and, as a last-ditch effort to save it, Philip and Jeanne Wayre founded the Otter Trust. Its base

otter

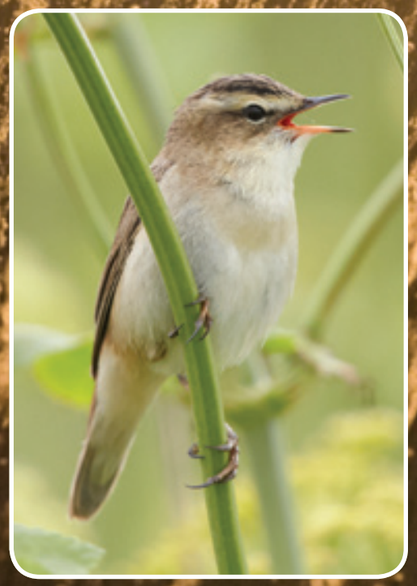
was on the Norfolk-Suffolk border near Bungay and its intention was to breed otters in captivity for future reintroduction. Slowly the captive population rose and, with a ban on some pesticides in place, it became possible to restock carefully selected rivers in East Anglia with otters. The banning of some pesticides, cleaner rivers and reintroduction programmes have all helped the otter, and today, it is again breeding along rivers across Norfolk. In 2006, with its mission wholly accomplished, the Otter Trust was dissolved.

The Otter Trust gifted two of its nature reserves to Norfolk Wildlife Trust to be managed for otters and all wildlife. Today, thanks to the work of these visionary conservationists, otters are found all over Norfolk, and the Bure Valley Living Landscape is among the best places for finding them. If you are looking for otters, try a vigil on the observation platform at NWT Barton Broad or NWT Ranworth Broad in winter; otters are regularly seen from both.

On the way back we passed a reed-bed alive with the free improvisation of a sedge warbler ensemble, performing solos like earthy, uninhibited saxophones.

Roger Deakin

Waterlog, A Swimmer's Journey through Britain



sedge warbler

Reedbed and Fen

A walk through a reedbed is an immersion in a many-dimensional habitat. Through your fingers run this year's blade-like leaves, still sharp and fresh with the spring. In your ears is the gossip of the wind in last year's brittle stems. Beyond is the free-wheeling song of a sedge warbler, newly here; his notes weaving through the reed, binding stem and stem, sound and space, claiming this cordon of reed, this straggled willow, for himself.

In parts, the reeds are struggling to compete with a bewildering mix of sedges, rushes, ferns and flowering plants: ragged robin, hemp agrimony, purple loosestrife, gipsywort and many others. Variable damselflies cling to rush stems and a swallowtail female, fat with eggs, skims the tops of the reed, searching for plants of milk parsley on which to lay them, one by one. A grasshopper warbler drily trills from a stand of meadowsweet and overhead a female marsh harrier – dark cocoa and golden syrup – sways in the gentle summer breeze. You have found a fen.

How were they formed?

Reed is what biologists call an r-selected species. This simply means they produce countless young – in the case of reed these are seeds – and invest very little in their individual survival. So reeds produce thousands of seeds every year and let them float away on the wind. Most end up in car parks, stuck in the fur of a passing fox or fall in dry, ploughed fields. A few fall on nice bare squelchy mud and grow to become reeds, which spread rhizomatously (which means they use horizontal underground stems) and colonise the mud around them. Thus a reedbed is formed.

Fen is floristically much more complex, with a rich mix of specialised plants. Though it seems counterintuitive, the richest open habitats in the UK are those which occur where there is fierce competition for nutrients. In higher-nutrient habitats a small number of species often predominate, as in a fertilised grassfield. Time is also a key factor, with the richest habitats tending to be the oldest. Fen occurs at sites where the water is alkaline, where nutrients are scarce, and where, usually through human management, woodland has been prevented from incurring for centuries.

Norfolk hawker

How have people used them?

Both reedbed and fen are the product of human and natural influences on the landscape. For hundreds of years reedbeds were cut annually in winter, to harvest valuable reed for thatching. Fen, by contrast, was harvested in summer, for the rich crop of hay and sedge it produced. Neither habitat would have the structure or the species composition it has today, were it not for centuries of human management.

DISCOVER – REEDBED and FEN

NWT Ranworth Broad • NWT Cockshoot Broad
NWT Upton Broad and Marshes • NWT Barton Broad
Trinity Broads • Catfield Fen • How Hill NNR

What special wildlife lives here?

Give a naturalist just one habitat in the Bure Valley Living Landscape to explore for the rest of her life and she will choose fen. Above any other habitat in the region, fen is home to rare and beautiful plants and invertebrates. Swallowtail, fen orchid, Norfolk hawker, variable damselfly, marsh lousewort, milk parsley, marsh pea, cowbane: they all make their home in fen. So too the antiseptically fragrant bog myrtle, the delicate grass of Parnassus and the towering bristly stems of marsh sow-thistle.

ragged robin

Feeding on the abundant frogs in a fen are plentiful grass snakes. On warm days from early summer common green grasshoppers rattle and later in the year they are joined by the too-high-to-hear whine of short-winged coneheads. This is both a naturalist's playground and a place where species' names are poetry.

Reedbed is floristically less diverse but is, equally, inhabited by fascinating animals. Lustrous peacock butterflies surf the breeze between stands of nettles at the reeds' edge and, more felt than heard, the sonorous sob of the bittern rises from the ooze, through your mud-heavy feet and legs, to sound in your own chest. Bearded tits chime from the dense reeds and in the stratospheric blue a pair of marsh harriers tumbles in display. These are among the special secrets of a reedbed.

What conservation challenges are there?

Such was the value of Broadland reed for thatching that for centuries large areas of reedbed were cut commercially each winter. In addition to producing an important crop, regular cutting had a biological impact. Given time reedbeds turn into wet woodlands, through a process known as succession. Reeds gather huge quantities of carbon from the atmosphere and use it to grow up to eight feet tall in a year. In winter reeds retreat beneath the marsh mud, leaving all of their growth from the previous summer above ground: beautiful but dead. These millions of dead reed-stems eventually fall to the ground and, with the passage of years, turn to layer upon layer of compost, raising the soil in the reedbed and making it drier underfoot. This makes the reedbed less habitable to the very species which has formed it – reed – and those species which depend on it. The rising soil also allows colonisation by woody species such as willows, guelder rose and alder buckthorn. The reedbed is on course to become a carr wood, full of marsh tits, treecreepers and honeysuckle, but devoid of bitterns.

Broadly the same scenario prevails for fen. Like reedbed, it is a habitat which has ceased to have a commercial value and has therefore largely ceased to be managed. Historically fens were cut in summer for marsh hay. This both removed living material, preventing the build-up of compost, and killed the seedlings of trees and bushes. As in the reedbeds, succession to other habitats was stalled. Since the middle of the twentieth century we have largely stopped harvesting hay in England. Furthermore, we have developed better and better pumps for draining wet habitats and have invented nitrate fertilisers which allow a few grass species to outcompete flowering plants. All in all, the twentieth century was a bad time to be a fenland specialist.

Modern conservation organisations manage reedbed and fen just as traditional broadlanders did: by harvesting their natural crops. Today the reedbeds and fens of the Bure Valley Living Landscape are better cared for than they have been for decades.

Reedbeds and fens are full of specialist species:

common reed
ragged robin
skullcap
alder buckthorn
woody nightshade
grass of Parnassus
yellow flag iris
milk parsley

reed warbler
sedge warbler
Cetti's warbler
reed bunting
bittern
marsh harrier
bearded tit
water rail

otter
red deer
Chinese water deer
harvest mouse
grass snake
common frog

swallowtail
peacock butterfly
brimstone
Fenn's wainscot moth
common green grasshopper
lesser marsh grasshopper
short-winged conehead

swallowtail and its caterpillars

A Broadland endemic

When used by naturalists, the word endemic means that a creature is found no-where else. So, as most of us know, the giant panda is endemic to China. What we may not know is that there is a butterfly which is endemic to Broadland, found only in Norfolk and extreme north Suffolk. What's more, it's the largest butterfly in the UK. It isn't an endemic species; it's an endemic subspecies of the swallowtail. On the continent, beautiful swallowtail butterflies live in many open habitats, and will cheerfully lay their eggs on several species of Apiaceae (that's the carrot family to you and me). Our Norfolk subspecies, by contrast, makes life very difficult for itself and for conservationists. The first difficulty is getting its name right: Papilio machaon britannicus. Far more significant difficulties arise from the fact that britannicus will only live in fen and will only lay its eggs on one fussy fenland species of the carrot family, known as milk parsley. To make matters worse, swallowtail caterpillars are partly carnivorous and will blithely chomp their way through their siblings. So a female swallowtail lays only one egg on each rare plant before setting off in search of another.

Once hatched the caterpillars, each in splendid isolation, undergo some remarkable transformations. They begin life looking like tiny black-and-white specks of bird poo. After three moults of their exoskeletons, the now much larger larvae take on a jaunty pattern of green, black and orange stripes and spots. To complete the effect, when threatened they can protrude a foul-smelling osmeterium, which looks like a pair of orange horns, from just behind their heads. Once fully grown they climb to the base of the reeds and pupate close to the surface of the water. They will remain as pupae for the whole winter and spring, to emerge as gaudy adults on a warm day in early summer.

Freshwater grazing marsh

A freshwater grazing marsh does exactly what it says on the tin. It is a wet grassland, often seasonally flooded with freshwater, and it is used for grazing livestock such as sheep, cattle and horses. Though less floristically diverse than fen, unimproved grazing marsh is rich in plants and is critically important for resident and migratory waterbirds. Wading birds breed here and both waterfowl and waders may winter in large numbers. The grazing marshes of Broadland are crisscrossed by hundreds of drainage dykes. These serve both as a home to many specialised plants and animals and as a corridor enabling water-dwelling species to move themselves and their genes across the landscape.

How was it formed?

In ancient days what is now grazing marsh would have been more deeply flooded, part of a natural Broadland delta which at times through history was freshwater and at times saline. The dykes which carve Broadland into a chessboard of grazing marshes were dug to drain these habitats and thus make the region more manageable and productive. With the digging of dykes began the ceaseless battle between Broadland farmers and the water which ever threatens to reclaim their land.

The county's native sheep breed, the Norfolk horn, was traditionally raised in marshes but declined to near-extinction with their enclosure, drainage and neglect in the twentieth century. Today grazing marshes are principally grazed by cattle.

Soon there will be wild geese flighting in from sea at dusk. Wild duck will come on sibilant wings in green-washed dawns, and hares will crouch in rusty reeds on the flat, far marshes. There will be snipe by the dyke-sides, and coots in black flotillas.

J. Wentworth Day
Marshland Adventure

How have people used it?

The clue is in the name. They have grazed livestock on them. Grazing marshes have also commonly been used for wildfowling and rough-shooting pheasants and waterfowl.

NWT Upton Broad and Marshes (grazing marsh)

DISCOVER – GRAZING MARSH

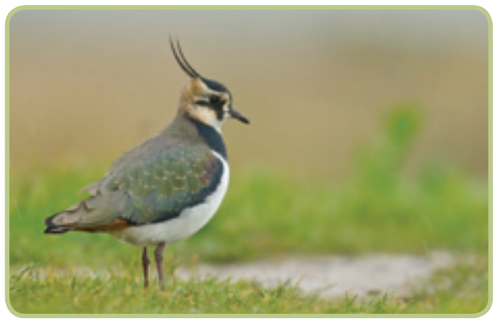
NWT Upton Broad and Marshes
South Walsham Marshes • St Benet's Abbey

What special wildlife lives here?

Winter in grazing marshes is all about the whistle of wigeon and the soft piping of hundreds of golden plover huddled in the rough grass. Flocks of pink-footed geese may be here too, loudly yapping the news of their summer in Iceland. Meadow pipits and skylarks are plentiful, and in the wettest patches there may be water pipits and snipe. The snipe burst into flight, with the sound of tearing Velcro, at the approach of a ringtail hen harrier, swaying in the icy wind which buffets the grass and all its inhabitants.

common snipe

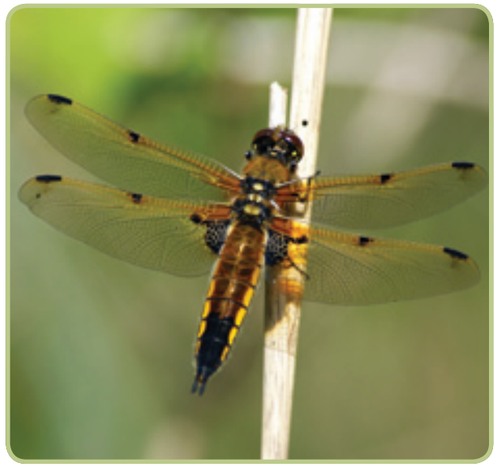
In summer the larks are aloft, reeling their intricate songs into the sky; beside them, tumbling to earth are lapwings, flashing black-and-white as they loop and dive in display. The meadow pipits are here still, singing their strident songs from the fence posts, but the waterfowl have left for their northern breeding grounds; all except the mallards and greylags which nest along the edges of the dykes.



lapwing

In both summer and winter one of Britain's rarest breeding birds, the common crane, may be seen, or its wild bugling call heard, in the grazing marshes of the Bure valley. This elegant and beautiful bird is a wonderful symbol of this unique and precious wetland landscape.

Where a dyke cuts through the grazing marsh, the water's surface is ablaze with territorial dragonflies, over a mat of floating water soldier. Four-spotted chasers sunbathe, stiff-winged, on every snapped-off reed stem, blue-green male hairy dragonflies patrol emergent vegetation, searching for reticent females, and wherever plants break the water's surface heart-shaped mating pairs of azure damselflies prepare to lay their eggs. Underneath the water rare pondweeds flourish unobserved and in the banks shy water voles hide in their burrows.



four-spotted chaser

What conservation challenges are there?

At NWT Upton Broad and Marshes Norfolk Wildlife Trust has recently purchased extensive areas of drained marsh and is engaged in restoring them. Water levels are being raised and grazing carefully managed to encourage the return of winter waterfowl and breeding waders. Wetland habitats, some of which had previously been reclaimed as arable farmland, are being restored and reconnected on a landscape scale.

In the longer term, the low-lying nature of grazing marshes makes them very vulnerable to sea-level rise and the saltwater flooding occasioned by extreme tidal and weather events.

Grazing marsh is teeming with wildlife, just look at what you could see:

greater water parsnip
grass-wrack pondweed
cuckoo flower
water soldier

lapwing
redshank
wigeon
mallard
pink-footed goose
barn owl
hen harrier
common crane

Chinese water deer
water vole
water shrew
fox
grass snake
common frog

Norfolk hawker
four-spotted chaser
hairy dragonfly
azure damselfly
orange-tip
green-veined white

water soldier

pink-footed geese

Chinese water deer

Here to stay

At the start of the twentieth century, Chinese water deer were introduced to Bedfordshire. These shy, attractive animals gradually spread through the wetlands of East Anglia and today their range centres on the Fens and the Broads. Chinese water deer are the only British deer in which males have no antlers: their threats and fights are carried out with tusk-like canines in their upper jaws.

Chinese water deer are largely solitary, though they gather in early winter to rut and mate. The resulting young are born in early summer and, whereas most deer have a single fawn, in water deer twins and triplets are common and even sextuplets are possible. As they occur in restricted habitats and pose little threat to economic activities such as agriculture and forestry, Chinese water deer have slipped unobtrusively into the British countryside. They remain hard to find and the grazing marshes of Broadland are probably the best habitat in which to look for them.

The broads of the Bure and Ant valleys

What would Broadland be without its broads? If nothing else, nameless. The broads of the Bure and Ant valleys are as quintessential to the natural and cultural landscape as the rivers. Made by people and shaped by nature, they have for centuries been home, larder, thoroughfare and playground to both people and wild creatures. Wroxham, Salhouse, Cockshoot, Ranworth, South Walsham, Upton and Trinity Broads in the Bure, Barton and Alderfen Broads in the Ant, and numerous others in secret corners or in private hands: each has its unique feel, its own history of human habitation and use, its own sounds and its own silence.

How were they formed?

Though Broadland has been explored by naturalists and geographers for centuries, the origin of its eponymous broads remained a subject of debate until the 1950s when it was conclusively established that most of these shallow freshwater lakes were created by mediaeval peat-diggers, using nothing but spades and their own strength. Even the largest of the broads, Hickling in the Thurne catchment and Barton in the Ant, were created by the hand of man when peat was a valuable fuel and was traded over hundreds of miles. In the low-lying, riverine landscape of Broadland the broads readily flooded to become lakes. It wasn't until much later that the cuts were dug between the broads and nearby rivers. These were created to aid the extraction of natural materials, including waterfowl, reed, fish, mammal pelts and marsh hay, and their transport by river to markets in Norwich and London.

NWT Alderfen Broad

> *Sandmartins and warblers deserted their old haunts; kingfishers and herons remained. The reeds sighed in the songless days, the flags curled as they withered, and their brittle tops were broken by the rains.*
>
> **Henry Williamson**
> Tarka the Otter

How have people used them?

The broads are the product of human activity. Since their creation, to this day, they have been used for a wide range of commercial and pleasure activities, including fishing, shooting waterfowl, fur-trapping, sailing, research and, more recently, tourism.

One unusual commercial use, the remains of which may still just be detected at NWT Ranworth Broad, was wildfowl decoying. A funnel-like trap was built on an arm of the broad and both tame waterfowl and grain were used to attract wild birds. Ducks would then be lured into the cage at the end of the funnel by their natural response to predators on land, which is to keep them in sight by swimming towards them. In this case the predator was a specially trained, fox-like dog which darted in and out of view, drawing the birds into the traps.

What special wildlife lives here?

Throughout the Broads, rich aquatic ecosystems are found in wetlands of human origin. Least observable, though perhaps most important, are the communities of freshwater plants which inhabit the broads. They range from the common, such as yellow and white water lilies, to rare pondweeds and stoneworts and the very rare holly-leaved naiad. Sadly these rare plants declined enormously in the twentieth century as a result of changes in water quality.

holly-leaved naiad

yellow flag iris

Where there is diverse and abundant plant life, there is also diverse animal life. Fish are plentiful and support many predators including kingfishers, great crested grebes, common terns, otters and some of the largest pike known in the country. The most obvious animals of the man-made open-water habitats are waterbirds. Large numbers of ducks winter on the open water of Broadland – wigeon, shoveler, teal, tufted duck, pochard, gadwall and mallard – and some stay to breed. Joining them at winter roosts on some broads are gulls and cormorants. In summer, where suitable islands are to be found, black-headed gulls stay to breed, beside common terns, newly arrived from Africa.

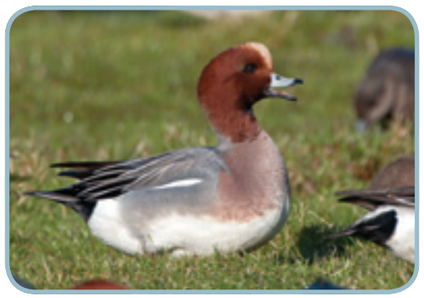
Put simply, the broads are among the most important bodies of water for plant and animal life in lowland Britain.

What conservation challenges are there?

The broads, like the rivers which run by them, suffered greatly in the twentieth century from contamination with nitrate fertilisers and untreated effluent. The over-prevalence of nutrients, known as eutrophication, often leads to an abundance of a few species at the expense of many rarer ones. Broads, such as NWT Alderfen, which were once famously clear-watered and carpeted with rare aquatic plants became sludge green and lost their precious plant communities. Though water quality is now generally better, and effluent from sewage plants and boats much better controlled, it is likely that the water, and biodiversity, of the broads have been permanently damaged. A few broads, notably NWT Cockshoot and NWT Barton, have been cleaned, with tons of nutrient-rich sediment removed, but to do the same across the whole landscape would be prohibitively labour-intensive and costly.

Visitor Centre, NWT Ranworth Broad

As is the case with all habitats in the lower valleys of the Bure and Ant, the broads are potentially subject to flooding from the sea. With rising sea level and increased frequency of severe weather and tidal events, incursion of saltwater must be seen as a possibility anywhere in the low-lying areas of Broadland.



wigeon

DISCOVER – BROADS

NWT Barton Broad • NWT Alderfen Broad
NWT Ranworth Broad
NWT Cockshoot Broad • Trinity Broads
Wroxham Broad • Salhouse Broad

Get down to the broad's edge, see what you can find:

holly-leaved naiad
yellow water lily
white water lily
pondweeds
hornworts
stoneworts

wigeon
teal
gadwall
tufted duck
pochard
great crested grebe
kingfisher
common tern
black-headed gull

otter
water vole
tench
perch
pike
roach

red-eyed damselfly
common blue damselfly

common tern
water vole

blue-tailed damselfly

otter

Zooplankton to the rescue

By the 1970s, NWT Barton Broad had ceased to have clear water. Thanks to phosphate emissions from sewage treatment plants and nitrate run-off from farmland, its water was murky green with algae and its underwater plant communities had died, starved of light. Faced with the second largest broad ceasing to have value for wildlife or even, thanks to sediment build-up, for recreational sailors, the Broads Authority implemented the daring Clearwater 2000 project.

Clearwater 2000 had two principal elements, dredging and biomanipulation. Suction dredging took place from 1996 to 2001 and extracted 305,000m^2 of sediment, thus maintaining navigable channels for sailors and, crucially, removing vast quantities of algae-fuelling nutrients, especially phosphorous, from the broad. Because overpopulation of fish leads to over-predation of water-cleaning zooplankton such as Daphnia, the next phase, known as biomanipulation, involved creating exclosures on branches of the broad, using unique floating fish curtains, and removing plankton-gobbling fish from within them. Many fewer fish meant much healthier populations of algae-grazing zooplankton in the exclosures. This led to clear water and – as if by magic – the return of numerous pondweeds, hornworts, and other water plants which had not been recorded in decades.

Farms, villages and towns

Farms, villages and towns are, of course, intended as habitat for people. They are where we live and where we produce the food we eat. Until very recently, we have not built our homes or farmed our land with any concern for wildlife. Wildlife, however, is amazingly adaptable and many species have either benefited from our dominion over the landscape or have learned to live with us. Thus open-country species, such as skylarks and yellowhammers, moved into our farm fields and woodland edge species, such as tits, finches and many butterflies, took advantage of the resources we provided in our gardens. Today, with the intensification of farming and the spread of tarmac and concrete across the landscape, many species which were once associated with farmland, parks and gardens have declined. Their disappearance is not their loss alone. It is a loss to us all: a healthy habitat for wildlife is a healthy habitat for humanity.

How were they formed?

Across lowland Britain, arable farmland is the result of people felling forest, which is the natural habitat of most well-drained soils on our island. Large-scale forest clearance took place in the Bronze Age, between four and five thousand years ago, leaving much of lowland Britain with the open landscape with which we are familiar today.

Villages and the few towns in the Bure Valley Living Landscape have tended to form along waterways, as it was here that valuable resources and the means of transporting them were concentrated. Whereas in much of the countryside, human habitation forms linearly along roads, in Broadland it has formed along rivers and broads.

How have people used them?

The whole history of farmland and villages in the Bure Valley Living Landscape is one of human use. These are landscapes created by humans and maintained by humans solely for their own ends. The wildlife living in them is resourceful and opportunistic and has taken advantage of the landscapes we have created. Indeed, many of the species we readily associate with farmland – rabbits, brown hares, brown rats, red-legged partridges and pheasants – are non-native and were brought here by people, in some cases centuries ago.

brown hare

What special wildlife lives here?

Farmland, villages and towns in Broadland, and perhaps most particularly in the Bure Valley Living Landscape are uniquely privileged. The largest human settlement in the Living Landscape is divided into two towns, Hoveton and Wroxham, by the biodiverse Bure. At the edge of town is Wroxham Broad and all around are minor wetlands and patches of wild ground. Perhaps nowhere else is it possible to see hobbies, marsh harriers, common terns, otters, marsh tits, swallowtails and kingfishers in the centre of a bustling town, and to consider them urban wildlife. Perhaps nowhere else is it possible to row for just a few minutes from your house to a tranquil broad where great crested grebes display, Cetti's warblers sing, swallows loop and dive and tufted ducks marshal their sooty ducklings.

What conservation challenges are there?

In the twentieth century the nature of farming changed radically. Tractors and other machinery replaced the power of the horse and the human hand, and thousands of miles of hedgerow were removed to make larger, more profitable fields. With the introduction of chemical fertilisers, farms became less diverse, devoting themselves to fewer crops. Fewer farms raised livestock, so farmyards became tidier and thus worse for birds and other wildlife. Furthermore, stubble, with all the grain and weed seeds it contained, was no longer left standing through the winter. Farmland became increasingly hostile habitat for what we term farmland wildlife. The challenge in farmland across the UK is to maintain productivity while allowing wild plants and animals to flourish.

In gardens the challenge is to stop seeing them as our own patches and start perceiving them as part of a landscape which is inhabited by many other creatures. Together our gardens offer both habitat and corridor for many species which naturally occur in scrub or woodland edge. Gardens are our opportunity to make little nature reserves and manage them for as diverse a range of wildlife as possible.

common poppy

When is a weed not a weed?

Weeds: nasty little blighters that pop up in the flowerbeds as soon as you turn your back. Spray them, dig them up, get rid of them! Well no: a weed is just a plant, like any other plant. The problem is that we humans have a loopy need to classify everything around us, according to what we think we can get from it. Crops, therefore, are good plants; but weeds, obviously, are bad plants. They're plants growing in the wrong place and, what's more, they're plants that have the temerity to grow where we want to grow crops. How dare they?

But think again. Think of a field of poppies. Everybody loves poppies. Well, poppies are the ultimate in arable weeds. Like all the other arable weeds they have tiny seeds which are easily dispersed and can live, un-germinated, for decades or even centuries. When soil is disturbed, by a plough for example, these resourceful seeds leap into action, grow fast, flower, and set seeds which may themselves spend decades in the soil before growing. Thought about like that, these weeds are amazing. For centuries they've taken advantage of our methods of farming, to grow in fields intended for our crops. In the twentieth century, however, we started farming intensively and using selective herbicides, with the result that arable weeds have become one of the most threatened groups of plants in the UK.

But they're not just rare: they're also beautiful. Arable weeds in Norfolk include such beauties as poppies, Venus' looking-glass, corn marigold and night-flowering catchfly. If we hadn't already decided they were weeds, we'd love them.

Parts of Norfolk are recognised as nationally significant for their populations of arable weeds. People of Norfolk, here's something to be proud of: rare weeds!

Don't ignore farmland – there's plenty of wildlife there too:

purple loosestrife
gypsywort
greater willowherb
buddleja
stinging nettle
cow parsley
hogweed

yellowhammer
chaffinch
great tit
coot
black-headed gull
mute swan
greylag goose
Egyptian goose

brown hare
common frog
common toad
grass snake
otter

small tortoiseshell
peacock
red admiral
brimstone
buff-tailed bumblebee
red-tailed bumblebee
white-tailed bumblebee

red admiral

Cow parsley

It was not all that long ago when the highest we could ascend was a tower or a mountain, a tree or a cliff. What was this to the ascending lark? A poised collection of these incessantly singing creatures seems to be suspended by the intangible nature of their song over the great field leading down to the farm. Although clouds are absent these birds are still too distant to see but their voices are magnified by space.

Ronald Blythe
A Year at Bottengoms Farm

Woods

Woods are what Britain wants to be. In most of the countryside of lowland Britain, the climax community – the habitat that happens if landscape is left to manage itself – is deciduous woodland. Along rivers, especially the sluggish rivers of flat East Anglia, the climax community is often carr woodland.

Being the most structurally diverse habitats in the UK, and the closest to the wildwood which covered our island before humans denuded it, woods are the most biologically diverse habitats we have. They have fascinating communities of plants, animals, fungi and other organisms in their leaf litter, in their understoreys, in their shrub layers, in their canopies, in their natural glades and gaps.

Perhaps it is for these reasons that woods also have the strongest hold over human imagination, whether our reaction be romantic, creative or fearful. They are the places of dreams, of poems, of paintings and of dark fairy stories. Without them, we would not be who we are.

How were they formed?

Much of the woodland in the Bure Valley Living Landscape is carr. A carr is a wood that is wet; as simple as that. And because it is wet it is composed of a different range of trees and shrubs to a dry wood. In an East Anglian carr, the trees are largely alders, which are uniquely adapted to growing in waterlogged soils. With them grow willows, guelder rose, redcurrant and many ferns.

Carr woods generally follow river valleys and are common by the rivers and broads of the Bure Valley Living Landscape, where soils are wet and prone to flooding. They have often formed by the process of succession from open water habitats, known as a hydrosere. To cut a long, very watery story short, algae and water plants take in carbon from the atmosphere and, via the clever trick known as photosynthesis, they use it to build themselves. Over time – lots and lots of time – dead plants and algae become compost and raise the level of the soil in the water. Eventually the water becomes muddy and shallow enough for the windborne seeds of plants like reed and bulrush to colonise and the mud becomes a marsh. The reeds take even more carbon from the atmosphere and make even more mud. Before you know it there is soil and trees are moving in. Hey presto: a carr wood.

Away from rivers and broads, on drier ground, there are areas of non-flooded woodland, dominated by oak and comparable to oak woods in the rest of Norfolk.

How have people used them?

In one sense, carr is not a useful habitat as it is too wet for agriculture or grazing and too dense for hunting. However, it is a source of many resources which people have valued for centuries. Alder trees themselves have traditionally been used to make pilings for use in water as, not surprisingly, their wood is very resistant to rotting. Growing under the canopy of alders, are many species of plant which humans have put to use. They include tussock sedges which were cut and used as stools, wild herbs such as water mint and wild angelica, wild hops, and honeysuckle which was used to make rope.

Dry oak-dominated woods also offered many resources and opportunities. These included timber, wood for burning and making hurdles, game, nuts, mushrooms, medicinal plants, and forage for livestock.

water mint

What special wildlife lives here?

On a bright day in winter, head to a carr wood to see it at its best. Now the horizontal sun glazes the trunks of the tall dark alders, in whose crowns siskins and redpolls feed in acrobatic flocks. Near them a family of long-tailed tits trills in alarm as a sparrowhawk bursts by in powerful flaps. A marsh tit sneezes and a Cetti's warbler brightly plinks from the edge of the fen beyond. Now honeysuckle's twisted fingers are laid bare, hops reduced to sandpapery straggles, now the low sun blinds you through the glass-red berries of guelder rose.


siskin

In spring the leaves of the wood will come; in summer its honeysuckle will flower; its watermint and meadowsweet and fen bedstraw will sprout through the ooze to blossom themselves. Birds' eggs will hatch, insects will fly and visitors will come. But it is now, in midwinter, that the carr wood shares its beauty best.

What conservation challenges are there?

Since carr is the main woodland type in the Bure Valley Living Landscape, the main conservation challenge which conservationists have taken up is – somewhat counter-intuitively – chopping it down and preventing more of it from developing. In a wholly natural landscape, rivers changing course, wild boar bashing through reedbeds and other landscape-scale factors would constantly create new areas of shallow water which, with time, would become reedbed and eventually carr. In a wild landscape, unchanged and unmanaged by humans, such processes would happen, on a landscape scale, all the time.

We however live in a landscape which for millennia has looked nothing like its natural self and in the past century we have changed it so much that the in-between habitats such as reedbed and fen, which are always poised to become something woodier, have become very scarce indeed. Thus conservationists, driven by the need to protect rare species and by our deep-rooted cultural relationship with the landscape, fight to preserve them, even if that means carving up a few corners of carr woods.

A partnership based on nitrogen

Alder is the single most important tree in a carr wood and gives it its unique feel. Alders are best appreciated in winter. Their central trunks are straight and their branches are longer at the bottom than at the top, giving them a characteristic Christmas-tree-like silhouette. As they keep their blackish seed cones through the winter, bare alders look distinctively dark. These trees are not only beautiful; they are also exquisitely adapted to the flooded environments in which they grow. To counteract the difficulty of obtaining nutrients in watery soils, alders have a symbiotic relationship with bacteria which live in large orange-coloured nodules in their roots. The bacteria are nitrogen-fixing, meaning they can take nitrogen (which is essential for making proteins) from the air and make it available to the trees. The trees in turn provide the bacteria with sugars. In symbiosis, everyone wins.

You'd be surprised just how much wildlife there is in a carr woodland:

alder
guelder rose
hop
honeysuckle
blackcurrant
meadowsweet
royal fern
oak

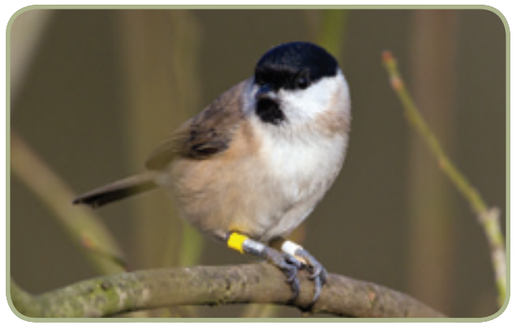
marsh tit
treecreeper
jay
robin
tawny owl
long-tailed tit
siskin
redpoll

red deer
hedgehog
stoat
grey squirrel

speckled wood butterfly
white admiral butterfly
orange-tip butterfly
sallow guest weevil

meadowsweet

marsh tit



stoat

The woodcock are already here, for they came in from Denmark and Scandinavia in the gold of the harvest moon, and lie crouched in little woods of oak and willow where the uplands meet the marshes.

J. Wentworth Day
Marshland Adventure

DISCOVER – WOODS

NWT Ranworth Broad • NWT Cockshoot Broad
NWT Upton Fen and Marshes
NWT Alderfen Broad
NWT Barton Broad • Salhouse Broad