ENGLISH NATURE

State of nature

Lowlands - future landscapes for wildlife

working today
for nature tomorrow

Contents

This report should be cited as:
Townshend, D., Stace, H., & Radley, D. 2004.
State of nature: Lowlands - future landscapes for wildlife.
Peterborough: English Nature.

Oxeye daisies, North Meadow, Cricklade NNR Wiltshire. Stephen Davis/English Nature

Foreword

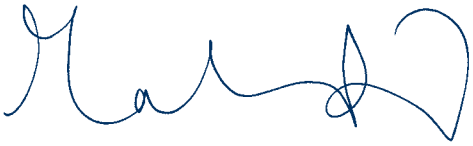
Wildlife and natural processes are essential to the way we live. An attractive environment, rich in wildlife, is vital for people's physical and mental well-being, for exercise, leisure pursuits and the relief of stress. It provides economic advantages for the location of business and housing, and contributes to the rural economy, particularly tourism. A healthy environment helps regulate our climate, alleviate flooding and pollinate our crops. Nature provides food and medicines, and can contribute to renewable energy. Wildlife also provides indicators enabling us to measure our quality of life.

However, in the lowlands of England the pressures on our diminishing wildlife are immense. Development continues, leading to increased demand for water and land. Modern farming practice results in intensive management of some areas (and minimal management of others), and pollution from agriculture, industry and transport affects our air and water. The impact of these pressures is made worse by their cumulative effects.

To achieve thriving wildlife and healthy, resilient ecosystems in 21st century lowland England, we all need to work together to create a new vision for wildlife landscapes. The vision must be relevant to all those who use and manage the land, to those who live in and visit it, and to both current and future generations. We should not attempt to re-create the past, but should agree a new future for lowland landscapes that recognises the legitimate needs of our modern society, and respects the needs of wildlife and the capacity of the environment.

We then need to make the vision a reality by involving all parts of society, from individuals to Government, in applying the principles of sustainability to decision-making. We need to use the opportunities that new policy frameworks provide, such as achieving wildlife gains through community strategies and at the regional level. And by involving and enthusing children, we can ensure that our new lowland landscapes for wildlife are protected and cherished in the future.

I hope that this report will stimulate collaboration to develop such a vision and to implement it. Our shared aim should be a brighter future for nature, and wide acceptance of its importance to the well-being of us all.



Sir Martin Doughty
Chair, English Nature

Footnote:
This report is the third in our State of nature series, the earlier publications covering uplands[1] and maritime[2]. As detailed information on lowland habitats and species is presented within the England Biodiversity Strategy[3], and the recent English Nature SSSI Condition Report[34], we have not repeated this in the current report, and readers are referred to the original sources.

Executive summary

Extensive, high quality habitats and landscapes rich in wildlife are now scarce in lowland England. Much wildlife found in the lowlands occurs in fragmented areas of semi-natural habitat, which are subject to a combination of pressures, including diffuse pollution, climate change and inappropriate management. The opportunity now exists to enhance the wildlife of lowland England through reconnecting habitats and improving their quality.

We must enhance wildlife in lowland England for future generations.
Paul Glendell/English Nature

This report describes the state of nature in lowland England, and examines how a variety of pressures impact upon habitats and species. It identifies conservation successes achieved through positive action, and stresses the importance of working in partnership. It demonstrates that a landscape-scale approach to nature conservation is essential, but can only be delivered by involving people more actively, through integrating policies more effectively, and through successful partnership at regional and local levels. It illustrates how the approach described in the England Biodiversity Strategy of delivering wildlife gains through working in partnership across sectors, can be put into action.

England is internationally renowned for its diverse lowland landscapes, created through the effects of climate and land use on the rich and diverse geology and landforms. However, the wildlife resource in lowland England suffered major decline in the twentieth century due to the impact of human activities, particularly agriculture, forestry and development. In the last 20 years stronger protection for wildlife, combined with changes in grants and support payments, have significantly reduced the rate of ongoing loss, and indeed promoted some restoration and re-creation. The UK Biodiversity Action Plan (BAP) has stimulated a systematic programme for the recovery of rare and threatened habitats and species, and there have been significant gains, such as reedbed creation and heathland restoration, recovery of the otter, and the return of lichens to urban areas.

Habitat destruction has taken its toll on lowland England, so that the total area of semi-natural habitat is now quite small and often fragmented. Whilst continuing habitat loss is no longer the major threat to lowland habitats, this report shows that there **continues to be a decline in the quality of habitats**. It shows that 31% of the area of lowland SSSIs is in unfavourable condition. This is better than for upland habitats but is well below the Government's target level of having no more than 5% in unfavourable condition by 2010. Some habitats fare better than others, reflecting the success of recent conservation measures. Lowland heathlands and grasslands are benefiting from major funding schemes, whereas lowland raised bogs and rivers continue to suffer from human impacts.

The main pressures on lowland wildlife responsible for this poor condition are agricultural intensification, lack of appropriate management, water quantity and quality problems, and the effects of development, invasive species, atmospheric pollution, and climate change.

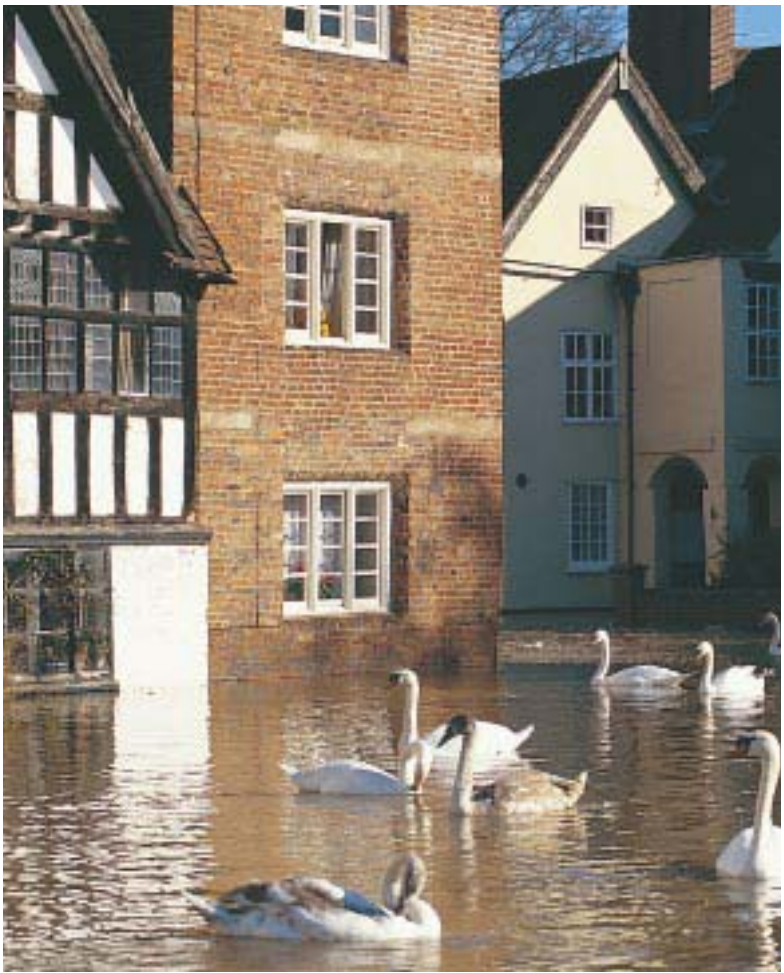
Intensive crop management with pesticides reduces wildlife on farmland and can also have impacts off-site.
Peter Roworth/English Nature

The main agricultural impacts are increased specialisation and intensification, and the associated use of pesticides. Some sites, such as small, isolated grasslands or heathlands, no longer fit within modern agricultural systems, and so are in decline through lack of appropriate management, particularly grazing. Agriculture also impacts upon wetlands, through diffuse pollution from fertiliser and manure, and through water abstraction for irrigation.

More than most other lowland habitats, wetlands are vulnerable to external pressures such as water abstraction. The health of wetland habitats for wildlife often depends on the management of the whole water catchment, not just what happens on individual sites. Damage to the water-holding capacity of a wetland can have impacts beyond the site, in particular flooding downstream. Wetlands are also particularly under pressure from non-native invasive species, which can force out our native wildlife. It can be very costly to control or eradicate these species. Many woodlands suffer from lack of appropriate management, such as the maintenance of open areas, and the impact of high deer numbers.

Development has a variety of impacts upon wildlife and geology, through new construction, associated infrastructure such as roads, mineral extraction, and water demand. Industrial and transport emissions are also a major contributor to atmospheric pollution, together with agricultural livestock. Climate change will be an additional pressure, and it will force species to shift their geographical range. This will be a problem if they are limited by their mobility or the availability of suitable alternative habitat.

Damaged wetlands and climate change can increase flooding. River Severn at Bewdley.
Paul Glendell/English Nature



These pressures and their cumulative effects mean that many remaining habitats are in poor condition, and are typically very fragmented and isolated within intensively-managed landscapes. Furthermore, the natural processes that we depend on, such as wetlands buffering flood waters, are being disrupted.

This report recognises the conservation successes that have been achieved, and identifies further action that is required to reduce the impact of each of the above pressures. It is clear that **a site-based approach alone will not meet England's national and international obligations for the conservation of habitats and species**, or many of the targets set under the UK BAP and the Public Service Agreements. The condition and resilience of protected sites must still be maintained or improved, since they act as wildlife refuges for threatened species, and are the core areas for the subsequent recovery and re-colonisation of land between these special sites. However,

the quality of the surrounding countryside is also vital. Nature conservation must now be achieved through a landscape-scale approach, which recognises that the demands of a modern economy will inevitably continue to influence land use in the lowlands. Integrated management of the whole landscape and water catchments is essential to facilitate recovery of biodiversity and increase the social and economic benefits that can be obtained through sustainable land use.

We highlight the value of nature to people, such as quality of life and economic benefits. We identify mechanisms that can be used to manage wildlife at landscape scales, to help fragmented and isolated habitat areas to be reconnected, managed properly, and set in a landscape that allows wildlife to flourish. The species within more resilient ecosystems will be better able to adapt to climate change. The mechanisms needed include more integrated policy frameworks that give greater importance to the protection of environmental assets, and promote the sustainable use of land, water and other environmental resources.

The report demonstrates the **progress that has been made on integrating wildlife into regeneration projects at the regional level, and there are excellent opportunities to develop these further**. Much of this is being achieved through partnerships, which incorporate sustainable tourism, spatial planning and environmental monitoring.

A vision for new lowland landscapes of England should be designed to integrate environmental and socio-economic objectives, and incorporate biodiversity as a valued and integral part of total land use. English Nature hopes that this report will stimulate further collaboration across all sectors of society, to achieve a brighter future for nature and its contribution to people's well-being.

The rare stone-curlew requires targeted agricultural management. Paul Glendell/English Nature

Unimproved grassland can be wildlife-rich and very attractive. North Meadow, Cricklade NNR. Stephen Davis/English Nature

The ten most critical actions required to deliver environmentally sustainable management in the English lowlands

Future landscapes for wildlife will need:

Investment in environmental quality and biodiversity recovery;

A landscape-scale approach to nature conservation;

Greater recognition of the value of nature to people's well-being and to the economy;

Integration of environmental goals within key economic sectors.

Active coppicing of woodlands for heath fritillary butterflies, Ham Street Woods NNR.
Stephen Davis/English Nature

Invest in better environmental management and wildlife recovery on farms – Ensure the reforms of the Common Agricultural Policy (linked to a further transfer of funds to the England Rural Development Programme) raise the environmental standards of agriculture through implementing cross-compliance, developing and rolling-out the Entry Level and Higher Level Environmental Stewardship Schemes, achieving full decoupling of subsidy and production payments. Target reductions in use and greater selectivity of pesticides.

Stimulate appropriate management of farmland and woodland – Promote the economic and nature conservation benefits of wildlife-rich farmland and woodland, including appropriate grazing, marketing of niche products, and tourism initiatives.

Improve water management – Continue investing in measures to reduce point source pollution, and develop a package of measures to reduce diffuse pollution from phosphorus, nitrogen and silt. Ensure the Water Framework Directive is implemented appropriately, to deliver proper catchment planning for all waters important for biodiversity.

Restore wetland habitats – Implement a significant programme of river, wetland and floodplain restoration.

Reduce the threats and impacts from non-native invasive species – Through the formulation and implementation of a national strategy, reduce the most serious threats and risks, and target species for priority action.

Reduce the cumulative impacts of development - Implement sustainable development principles in land use planning, and promote environmentally sustainable communities that make a positive overall contribution to biodiversity targets.

Reduce the adverse effects of transport – Increase understanding of the cumulative impacts of current and planned projects, develop incentives to minimise the environmental impact of road and air transport, and achieve better integration between different modes of transport.

Reduce atmospheric pollution – Ensure the national Air Quality Strategy takes greater account of nature conservation objectives by developing measures to reduce critical ecosystem loads, and reduce diffuse pollution emissions, especially ammonia from intensive livestock units.

Adapt to the impacts of climate change – Ensure that agriculture, forestry and development planning policies, and regional strategies, incorporate actions to reduce habitat fragmentation, so that species can respond better to the inevitable effects of climate change over the next 50 years.

Improve management of the impacts of access and recreation – Improve understanding and appreciation of wildlife through tourism, increase partnership projects that create new wildlife areas for people to enjoy, and zone areas of high wildlife and recreational value.

1 Introduction

England's 'green and pleasant' land brings to mind the rural idyll of pastoral scenes in lowland England. The small patchwork of hop fields, woodlands and chalk downlands of Kent, the heaths of Thomas Hardy's Wessex, and Sherwood Forest as a haunt for Robin Hood, exemplify our perceptions of lowland England. This varied range of landscapes, though dependent on the effects of climate and the rich and diverse geology, has been shaped by people's actions since the Stone Age. There are no natural landscapes or ecosystems remaining - all have been modified by people. Our modern landscapes reflect historical and modern land use, the contemporary effects of development, and the interests of people.

Round-headed rampion, found only on unimproved southern chalk grasslands.
David Townshend/English Nature

Today, most people in England live in towns and cities, which occupy only 7% of the land surface. Most of lowland England is farmland, and it is here that much of our remaining semi-natural habitats, such as species-rich grassland, heathland, fens and ancient woodlands, can be found.

Our modern population is increasingly distanced from an awareness of, and empathy with, nature. There appears to be an assumption the natural environment will provide clean air, water and food, and will cope with our waste. Many people are unaware that these services depend on the continued existence of natural processes such as soil creation, pollination of flowers and regulation of our climate.

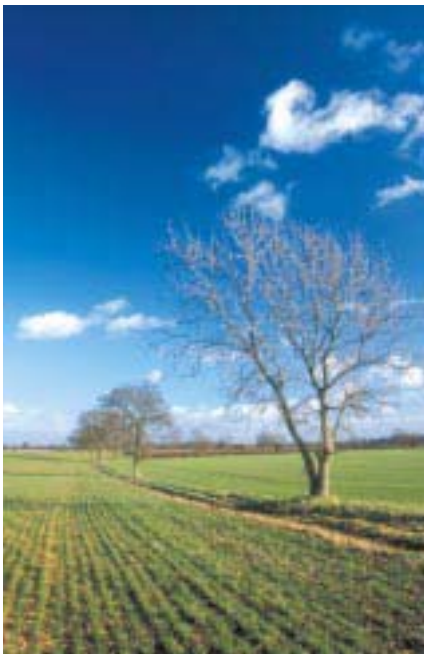
The colourful mosaic of dwarf shrubs on lowland heathland, Holt Heath NNR.
Peter Wakely/English Nature 18,404

Green tiger beetle, a declining but still widespread species of firm, sandy bare ground.
Roger Key/English Nature

As we have exploited our natural environment ever more intensively, we have given insufficient consideration to our wildlife and their habitats. Even though our landscapes at first glance may appear little different from 50 years ago, the 'green and pleasant' lowlands have in fact changed. Habitats are now degraded and fragmented, ecosystems are impoverished and once-common plants and animals are rarer and less widespread. These man-induced changes in the environment are not just an issue for wildlife. They also have had adverse effects on people's quality of life, through impacts on our health and our access to wildlife and greenspace, and damage to our property.

On our current course, the environment we pass on to our children will be less diverse and less able to recover quickly from adverse impacts. However, we can act to improve lowland England for the benefit of both wildlife and people.

This report builds on the England Biodiversity Strategy[3], showing how working in partnership across sectors can bring about benefits for wildlife. We describe the current state of wildlife in lowland England in terms of the UK Biodiversity Action Plan (BAP)[4] habitats and Sites of Special Scientific Interest (SSSIs).



Impoverished farmland landscape.
David Townshend/English Nature

We identify the major pressures on these habitats and how they result in fragmentation and decline in quality, how they impact on wildlife, and what we need to do to reduce their effect. We identify ways to manage wildlife at landscape scales, larger than individual sites, to allow fragmented and isolated habitat areas to be reconnected, managed properly, and set in a landscape that allows wildlife to flourish.

We highlight the value of nature to people, and advocate that the new lowland landscapes of England should be designed to integrate environmental and socio-economic objectives, thus ensuring that biodiversity is a valued and integral part of them.

We hope that this report will stimulate further collaboration across all sectors of society to achieve a brighter future for people and nature.

Poppies in a cereal field margin.
Paul Lacey/English Nature

2 The current state of lowland nature

This chapter examines the current state of wildlife in lowland England.

2.1 The wildlife resource

Farmland in lowland England is primarily intensively-managed pasture or arable fields. Yet even these landscapes can support special wildlife. The cereal field margins and ancient, species-rich hedgerows now support some of our rarest plants and animals, such as broad-leaved cudweed, tree sparrow, and barberry carpet moth, which are listed in the UK BAP. Farmland is vital for many birds of open country, such as skylark, lapwing and stone-curlew, and for species that use a mix of farmed and unfarmed habitats, such as brown hare and greater horseshoe bat.

On pasture, the most diverse wildlife is confined to the remaining areas of semi-natural grassland. Most well-managed semi-natural grasslands are rich in plant species, and typically can contain more than 20 plant species in a square metre. To keep this character and diversity they need to be managed, either by grazing or cutting for hay. These grasslands may be small isolated meadows, extensive stretches of chalk downland, or areas associated with springs or floodplains. They are home to a wide range of rare and scarce species, including some of international importance, such as orchids, butterflies and other invertebrates.

Early purple orchids on chalk downland.
Peter Wakely/English Nature 16,163

Lowland heathland is a colourful mosaic of dwarf shrubs, such as heather and gorse. It is found on poor, acidic soils, and supports rare plant and bird species, including nightjar and Dartford warbler. It also supports all 12 of the UK's reptile and amphibian species, and over half of the species of British dragonflies, damselflies and true bugs. Heathlands were once part of the farming system, managed mainly by low-intensity grazing. They provided many products such as turf, vegetation for fodder and fuel, and honey and wax, often harvested through common rights. Most of these traditional management practices have now disappeared, and our heathlands are suffering as a consequence.

Silver-studded blue, a rare lowland heathland butterfly.
Stephen Davis/English Nature

The Hampshire Avon, now benefiting from a River Conservation Strategy.
David Withrington/English Nature

England has a great variety of rivers, from the fast-flowing waters of the north and west to the more tranquil chalk streams in the south, and the broad river floodplains in the east of the country. Each type has its own special wildlife. The communities of plants and animals vary between rivers, and within a river from the headwaters to the middle section and the lower reaches. A number of rare species are found in rivers, such as white-clawed crayfish, and three species of lamprey. There are also lakes supporting species such as the medicinal leech and floating water-plantain.

Grazing marshes are grasslands in river floodplains or near the coast that are periodically flooded. Whilst most are grazed, some are also cut for hay or silage. They tend to have few plant species, but the differing sward heights, and frequent flooding in winter and spring, provide ideal feeding conditions for a range of overwintering birds, including internationally important populations of wildfowl. During spring, when the water levels drop, many breeding waders such as snipe and lapwing use the marshes. Drainage ditches within the marshes are extremely important for aquatic and bankside plants, such as pondweeds, and rarer plants, including frogbit, water-violet and bladderwort. The ditch systems are also important for water vole, and many invertebrates such as the great silver water beetle, hairy dragonfly and emerald damselfly.

Hacklinge Marshes, Kent. Stephen Davis/English Nature

Swamps and fens are similarly dependent upon water to maintain their wildlife interest, in this case derived from rainfall, groundwater seepage or over-bank flooding. Swamps dominated by reedbeds are particularly valuable for breeding birds such as bittern and bearded reedling, and invertebrates such as the swallowtail butterfly.

Lowland raised bogs form peat deposits up to several metres thick in basins, and on estuarine or river floodplains. The characteristic plants are *Sphagnum* bog-mosses and cottongrasses, and rare plants and invertebrates include bog-rosemary, mire pill beetle and bog bush cricket.

The richest areas of woodland are on sites that have been continuously wooded since at least 1600AD[5]. Typical woodland plants within these ancient woodlands are oak, ash, beech and birch in the tree layer; hazel, hawthorn and holly in the shrub layer; and dog's mercury, bluebells, primroses, bilberry and a wide range of mosses and liverworts in the ground flora. These woods also support many invertebrates and birds. Some of the conifer woodlands planted in the last century are important as habitat for red squirrels and, when recently replanted, for birds such as nightjar and woodlark.

In addition, some areas of ancient wood-pasture still remain in parts of England, and may form a mosaic of tree-covered and open habitats, such as acid grassland and heath. With abundant old trees and dead wood, wood-pastures are rich in fungi, dead-wood invertebrates and lichens that live on the bark.

Scrub, ranging from scattered bushes to woodland edge, and also closed canopy vegetation of shrubs and saplings, occurs in the lowlands on grassland, heathland, bog and woodland[6]. It is an important component in some habitats for a wide range of higher plants, invertebrates and birds, a number of which are nationally scarce.

Southern damselfly, a rare southern bog species.
Roger Key/English Nature

A carpet of ramsons in Hampton Alders, part of Wye and Crundale Downs SSSI.
Stephen Davis/English Nature

2.2 The role of sites and legislation

Nature conservation in England has a strong basis in legislation. This has been essential in the lowlands, where the pressures for 'improvement' of land are intense. Legislation has helped sustain some biodiversity value, but only for the designated sites. There is a variety of protective designations (see opposite) that have ensured the safeguard of our most important sites. But there is now a growing awareness that such sites, which are becoming increasingly isolated from each other as land use intensifies, are not enough. Unless the countryside around and between protected sites is amenable to wildlife, inbreeding and local extinction will lead to loss of species and general impoverishment within many of the protected sites.

Rockland Broad, part of the Yare Broads and Marshes SSSI, The Broads SAC, and Broadland SPA and Ramsar site. Peter Wakely/English Nature 22,147

Protected sites

Internationally important sites:

Special Areas of Conservation (SACs) are classified under European Union Directive 92/43/EEC known as the 'Habitats Directive'. This promotes the conservation of important, rare or threatened habitats and species across Europe. It lists 168 natural habitat types for conservation by designation as SACs, and 632 species whose conservation requires designation of their habitat as SACs. Those habitats and species at greatest risk are given 'priority' status.

Special Protection Areas (SPAs) are classified under the European Union Directive 79/409/EEC, known as the 'Birds Directive', to conserve the habitats of certain migratory or rare birds.

Together, SACs and SPAs form a network of protected sites that make up the **Natura 2000** series. The UK Government has made a formal commitment to maintaining these sites in 'favourable conservation status'.

Ramsar sites are internationally important wetland areas designated under the 1971 Ramsar Convention on 'Wetlands of International Importance, especially as Waterfowl Habitat'.

Nationally important sites:

Sites of Special Scientific Interest (SSSIs) are selected by English Nature and protected under the Government's wildlife legislation, strengthened by the Countryside & Rights of Way Act 2000. They form a nationally important series of the best and rarest examples of our wildlife and geological features.

National Nature Reserves (NNRs) are SSSIs managed by English Nature, or approved partners, specifically to conserve their wildlife features, and to allow people to experience nature at its best.

Locally important sites:

Local Nature Reserves (LNRs) are declared by local authorities, in consultation with English Nature, under Section 21 of the National Parks and Access to the Countryside Act, 1949. They are sites with wildlife or geological features that are of special interest locally, which give people opportunities to study, enjoy and have contact with nature.

Sites of Importance for Nature Conservation (SINCs) are identified by local authorities, with the assistance of county Wildlife Trusts, and used to inform planning decisions at the local level. This type of site has been recognised by Government as helping to contribute to the wider delivery of the Biodiversity Action Plan.

The tiny nail fungus, a BAP species occurring on lowland heathland.
Bob Gibbons/Natural Images

2.3 The UK Biodiversity Action Plan

The Government published the UK Biodiversity Action Plan (BAP) in 1994[7]. This contains a commitment to produce action plans for our most endangered or declining species, and for priority habitats that are either in decline, or are important for ecosystem function, or for which the UK has international obligations. Since 1994 the UK has prepared 391 Action Plans for priority species and 47 Action Plans for priority habitats. Of these, 347 Species Action Plans (SAPs) and 43 Habitat Action Plans (HAPs) are relevant to England. Many of these occur in the lowlands (see table opposite) although some also occur in coastal or upland areas.

The Government's England Biodiversity Strategy[9] aims to halt the declines in our priority habitats and species, and emphasises that our protected sites network has an important role to play. It recognises that, in order to sustain these sites and promote the recovery of biodiversity, we need the support of a healthy wider environment. The strategy also stresses that holistic approaches and partnerships across sectors are essential for achieving the conservation of biodiversity. Its ambitious aims are to achieve a general acceptance of the essential role of biodiversity in enhancing the quality of life, with conservation becoming a natural consideration in all relevant public, private and non-governmental decisions and policies.

To provide some measure of progress towards the achievement of the strategy's vision, a series of headline and sector indicators have been published showing trends over recent years. By 2010 a time series for these indicators will be available to help assess England's contribution to the global and European targets for biodiversity[25].

BAP lowland habitats and examples of associated species

BAP priority habitat	Estimated total extent of habitat in England	Number of BAP species reliant on this habitat[8]	Examples of BAP species that are associated with this habitat
Cereal field margins	18,309 ha	32	Brown hare, cirl bunting, broad-leaved cudweed
Ancient and/or species-rich hedgerows	278,000 km	36	Barberry carpet moth, orange-fruited elm lichen
Lowland meadows	8,500 ha	14	Skylark
Lowland calcareous grassland	38,450 ha	66	Chalk carpet moth, Cotswold pennycress, Adonis blue
Lowland acid grassland	20,500 ha	30	Field cricket, Deptford pink, stone-curlew, woodlark
Purple moor-grass and rush pastures	11,000 ha	15	Narrow-bordered bee hawk-moth, marsh fritillary
Lowland heathland	41,000 ha	79	Southern damselfly, sand lizard, heath tiger beetle, nail fungus
Chalk rivers	161 sites	12	Otter, white-clawed crayfish
Coastal and floodplain grazing marshes	229,000 ha	28	Lesser silver water beetle, shining ram's-horn snail, cut-grass
Aquifer-fed naturally fluctuating water bodies	20 ha	9	Water vole, ribbon-leaved water-plantain
Eutrophic standing waters	1,036 sites	28	Medicinal leech, tadpole shrimp, great crested newt
Mesotrophic lakes	108 sites	32	Vendace, holly-leaved naiad
Fens	8,107 ha	45	Fen orchid, crucifix ground beetle
Reedbeds	9,560 ha	11	Marsh mallow moth, bittern
Lowland raised bogs	11,419 ha	12	Mire pill beetle, Baltic bog-moss
Lowland beech and yew woodland	27,000 ha	21	Olive crescent moth, devil's bolete
Lowland mixed deciduous woodland	220,000 ha	51	Pearl-bordered fritillary, argent and sable moth, dormouse
Wet woodland	19,800 ha	26	Various craneflies
Wood-pastures and parkland	22,000 ha	56	Violet click beetle, oak polypore fungus
Upland ash woodland	37,120 ha	15	Lady's-slipper orchid, high brown fritillary
Upland oak woodland	212,500 ha	35	Blue ground beetle
Urban (& urban fringe) (BAP broad habitat)	Currently unknown	4	Song thrush, pipistrelle bat, stag beetle, shrill carder bee

2.4 Historical habitat losses

The twentieth century was a period of unprecedented change in the lowlands, particularly from the post-war period to the 1980s. Factors included cheap, readily available fertilisers and other agro-chemicals, the agricultural need to produce sufficient food to support Britain's population, and the demand for softwood products. Many wildlife habitats were lost through intensification of grasslands, drainage of wetlands, conifer planting in woodland and on heathland, and the destruction of raised bogs for peat extraction. These large-scale losses have been compounded by cumulative small-scale factors, such as straightening of wood edges and watercourses, removal of individual mature trees, and barn conversions. The major historical declines in habitats are well documented[10].

Summary of historical habitat losses

Habitat	Historical losses
Hedgerows	Many of England's hedgerows have been removed in recent decades to enlarge fields, especially where there is no further need for stockproof boundaries. Over 20% were lost between 1984 and 1990[11].
Lowland unimproved grassland	A 97% loss between 1930 and 1984 in England & Wales[12].
Heathland	An 84% loss between 1800 and the late 1980s[13].
Grazing marsh	Approximately 20,000 km^2 of wet grassland were drained between 1940 and 1980[14, 15]. In the north Thames, 48% of grazing marshes were lost between 1935 and 1982[16], and 49% of the Ouse, Nene and Welland Washes were converted to arable between 1939 and 1981[17].
Ponds	There have been heavy losses of ponds from infill and drainage with a 33% decline since the Second World War[18]. This loss represents a drop from about six ponds per km^2 pre-war to 1.7 ponds per km^2 in 1996[19].
Fens	In East Anglia, fens declined from an estimated 3,400 km^2 in 1637 to just 10 km^2 by 1984[20].
Lowland raised bog	About 44%[21] of the original 37,700 ha of bog has been drained, cut and claimed for agriculture, and cannot be regenerated in the short term. Just over 1%[22] remains undisturbed, and the remainder is degraded to varying degrees.
Ancient woodland	Between 1930 and 1985 about 7% of ancient woodland was cleared for farming or development, and about 38% was replanted, often with conifers. Now, only about 62% remains semi-natural[23, 24].

Loss of heathland to agriculture, Purdis Heath, part of Ipswich Heath SSSI.
Steve Clarke/SWT

A key aspect of past changes in land use has been the loss of fundamental life support processes (increasingly known as ecosystem services) for wildlife. The water cycle is now greatly modified to facilitate agricultural operations, water supply and flood alleviation. Modern cultivation and use of chemicals have broken the natural cycles of decomposition and depleted the soil fauna. Furthermore, the structure of the countryside is now less varied through the loss of small copses, hedgerows and field corners, so that species movement is severely restricted. As a result it is difficult for our remaining fragmented habitats to retain a full range of species.

2.5 Recent habitat losses and gains

Because of these historical losses, wildlife in the lowlands towards the end of the twentieth century existed in a highly fragmented landscape heavily modified by man. However, in the past 10-20 years there has been stronger protection of wildlife against the negative impacts of agriculture, forestry and development. There is now a more effective regulatory framework for development, alongside positive conservation measures[26], but the expansion of the road network, new housing, landfill and mineral extraction still threaten semi-natural grasslands, ancient woodlands, heathlands and raised bogs.

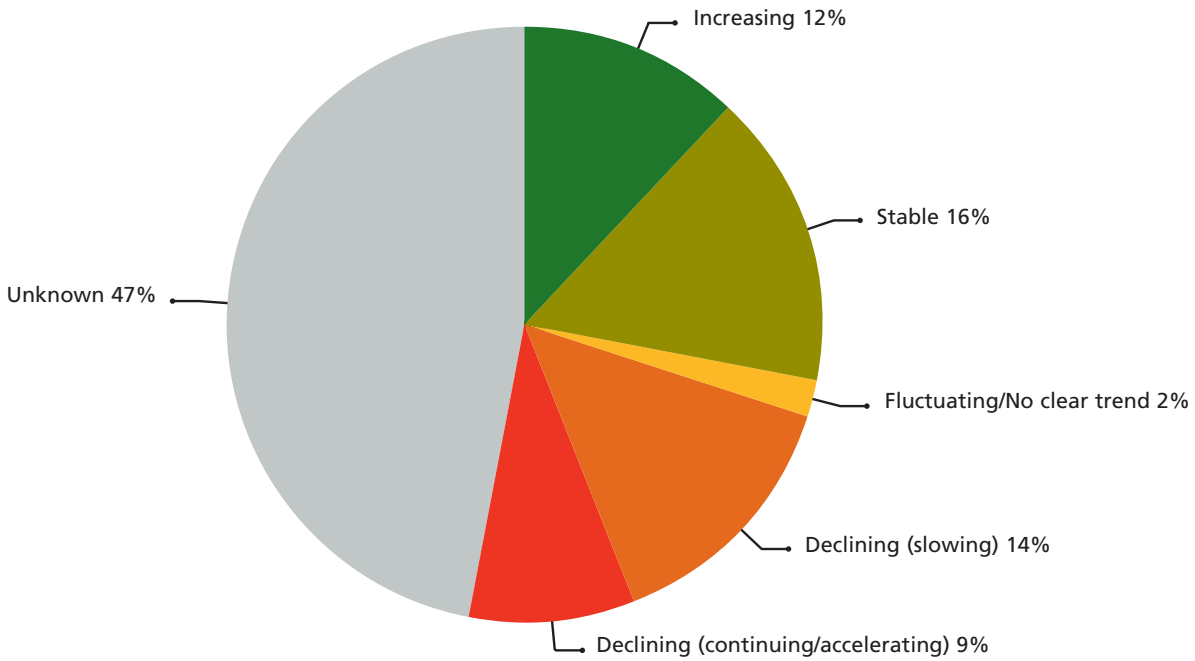
On the plus side, changes in grants and support payments have significantly reduced the impact of intensive agriculture upon our remaining wildlife, and have promoted restoration and re-creation. There are also habitat gains through direct action, such as reedbeds created as part of gravel quarry restorations, which provide extensive habitat for a range of species.

Former gravel workings restored as nature reserve, Lackford Lakes, Suffolk.
Paul Lacey/English Nature

Nevertheless, the UK BAP 2002[27] report shows that habitat losses still continue. Ten of the 43 BAP priority habitats in England are declining, including wood-pasture and parkland, fens, beech and yew woodland, and eutrophic and mesotrophic lakes. These losses have occurred particularly on land not protected by SSSI legislation.

Status of BAP priority habitats in England in 2002[28]

Total number of habitats: 43



Agricultural land use is identified as a significant problem on 82% of Habitat Action Plans (HAPs)[29], and species-rich grasslands that are not SSSIs have been particularly subject to continuing loss. Recent studies have shown that, after the destruction of 97% of our grassland by the 1980s[30], loss continued in the last two decades of the twentieth century[31]. In the Peak District, 76% of species-rich grassland were lost between the mid-1980s and the mid-1990s[32], whilst in Worcestershire, 6% of such grasslands were lost or damaged per year between 1980 and 1992[33].

To reverse the historical declines in BAP habitats in England, many of the HAPs have restoration and re-creation targets, and some successes have been achieved. Five out of 43 BAP habitats that occur in England are increasing, and there have been major increases for some habitats. About 800 ha of reedbeds and 2,000 ha of lowland heathland have been created in England's southern counties.

Further information on these successes is presented in chapter 3.

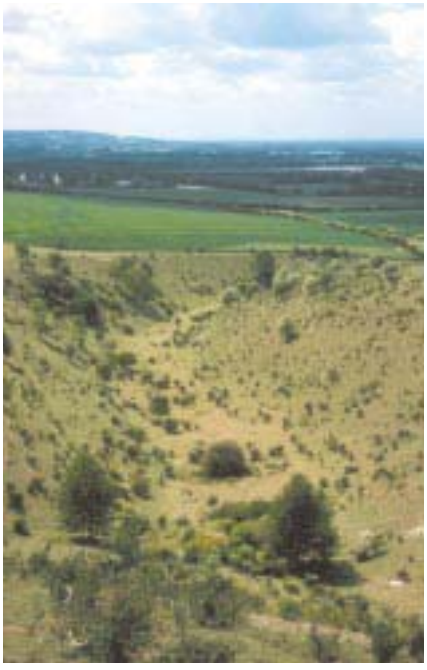
Chalk grassland in ideal management, Salisbury Plain SSSI.
Stephen Davis/English Nature

2.6 Condition of habitats

Whilst habitat destruction is no longer the major threat to lowland habitats, other pressures are resulting in a decline in the quality of habitats. The Government has set a Public Service Agreement (PSA) target to get 95% of SSSI land by area into favourable or recovering condition by 2010. English Nature carries out condition assessments to monitor SSSIs against this target, using a series of agreed common standards for each of the major nature conservation features. SSSIs are in unfavourable condition when they fail to meet these criteria. In 2003 English Nature completed the first six-year monitoring cycle[34]. During this period all SSSIs were visited at least once, and most were seen more frequently.

The overall assessment of habitats within SSSIs in lowland England shows that 69% of the SSSIs by area are in favourable condition. This compares with the overall figure for all SSSIs of 58%. Figures for **favourable condition** include (a) SSSIs where the habitat and species features are in a healthy state, and are being conserved for the future by appropriate management; and (b) SSSIs not in favourable condition, but where the necessary management is in place to address the reasons for unfavourable condition. The special habitat or species features of SSSIs recorded as **unfavourable no change** are in poor condition. Some beneficial management measures may be in place, and the features may be generally improving, but we cannot be certain that they will recover to favourable condition. **Unfavourable declining** sites may have some beneficial management in place but this is insufficient and the quality of their special features is bad and getting worse.

Chalk grassland in unfavourable declining condition due to progressive scrub encroachment.
Phil Grice/English Nature



Some habitats fare better than others, reflecting the success of recent conservation measures. For example, much lowland heathland has been brought into favourable condition through the major investment of the Tomorrow's Heathland Heritage project, funded by the Heritage Lottery Fund. Also the surviving grasslands are benefiting from the substantial effort through conservation management incentive schemes, funded by the Department for Environment, Food and Rural Affairs (Defra). In contrast, the poor condition of lowland raised bogs is a consequence of drainage and peat extraction, although the recent purchase of mineral rights on three key sites allows for remedial action. Likewise, many rivers are in unfavourable condition because they continue to suffer from abstraction and diffuse pollution.

The condition of lowland habitats on SSSIs in England

Habitat	Percentage in 'favourable' condition	Percentage in 'unfavourable no change' category	Percentage in 'unfavourable declining' category	Percentage lost
Total for all lowland habitats (715,000 ha)	69	15	16	0
Lowland acid grassland	82	16	2	0
Lowland calcareous grassland	79	6	15	0
Standing open waters*	69	22	9	0
Lowland heathland	68	17	15	0
Lowland meadows and pastures	67	21	11	1
Woodland and wood-pasture	67	22	11	0
Reedbeds	65	17	18	0
Grazing marshes	63	27	10	0
Purple moor-grass and pastures	61	29	9	1
Swamps and fens	53	25	22	0
Lowland raised bogs and mires	35	22	43	0
Rivers	32	60	8	0

Data from the first six-year monitoring cycle for SSSIs as at 30 September 2003[35].
* Standing open waters includes large reservoirs and gravel pits important for birds (60% of the total area) which influence the overall figure.

Condition assessments focus on the current state of the SSSI and are designed to identify changes that are needed in the management of the site to ensure that the important features are maintained. However, the condition of the surrounding landscape, which may be hard to quantify, may also have an influence on the longer-term sustainability of the feature. It is crucial, therefore, to improve the condition of the landscapes in which SSSIs occur.

The table overleaf lists the main causes of unfavourable condition for each habitat on SSSIs. The common themes, such as agricultural intensification, lack of appropriate management, and diffuse and direct pollution, are examined further in chapter 3.

Reasons for unfavourable condition of lowland habitats on SSSIs in England

SSSI habitat	Main causes of unfavourable condition
Lowland acid grassland	Undergrazing (resulting in excessive scrub). Nutrient enrichment, in particular the use of artificial fertilisers.
Lowland calcareous grassland	Undergrazing (resulting in excessive scrub). Nutrient enrichment, in particular the use of artificial fertilisers.
Standing open waters	Nutrient enrichment from diffuse and point sources. Siltation from diffuse sources. Invasion by non-native species. Stocking with bottom-feeding fish. Abstraction from groundwater (aquifer-fed lakes). Disturbance from recreational activities (mostly reservoirs).
Canals	Nutrient enrichment from diffuse and point sources. Invasion by non-native species. Disturbance from recreational boat traffic. Lack of appropriate management.
Lowland heathland	Undergrazing (resulting in excessive scrub). Lack of appropriate management. Nutrient enrichment due to atmospheric pollution mainly from nitrogen compounds. Invasion by non-native species.
Lowland meadows and pastures	Nutrient enrichment, in particular the use of artificial fertilisers. Undergrazing (lack of aftermath grazing). Inappropriate use of herbicides. Inappropriate water level management.
Woodland and wood-pasture	Lack of management or inappropriate management. Deer grazing and browsing. Drainage effects on woodland flora. Scrubbing-up of open space (such as rides) within woods.
Reedbeds	Coastal erosion. Coastal flood defence (maintenance/construction). Freshwater quality – diffuse and point source pollution, and siltation. Lack of corrective works – scrub control, ditch management or blocking.
Grazing marshes	Drainage. Lack of ditch management or blocking. Nutrient enrichment.
Purple moor-grass and rush pastures	Undergrazing (resulting in excessive scrub). Nutrient enrichment, in particular the use of artificial fertilisers. Inappropriate water level management.
Swamps and fens	Freshwater drainage and abstraction. Lack of corrective works – scrub control. Lack of corrective works – ditch management or blocking. Freshwater quality – diffuse and point source pollution. Agriculture – inappropriate grazing (under/overgrazing).
Lowland raised bogs and mires	Lack of corrective works – scrub control, ditch management or blocking. Atmospheric pollution (nitrogen oxides and sulphur dioxide). Inappropriate water level management. Planning permission for peat extraction.
Rivers and streams	Diffuse pollution from agriculture. Point-source pollution (sewage and industry). Physical modification (channel straightening and deepening). Invasive riparian species. Abstraction (particularly chalk rivers).

2.7 Species losses and gains

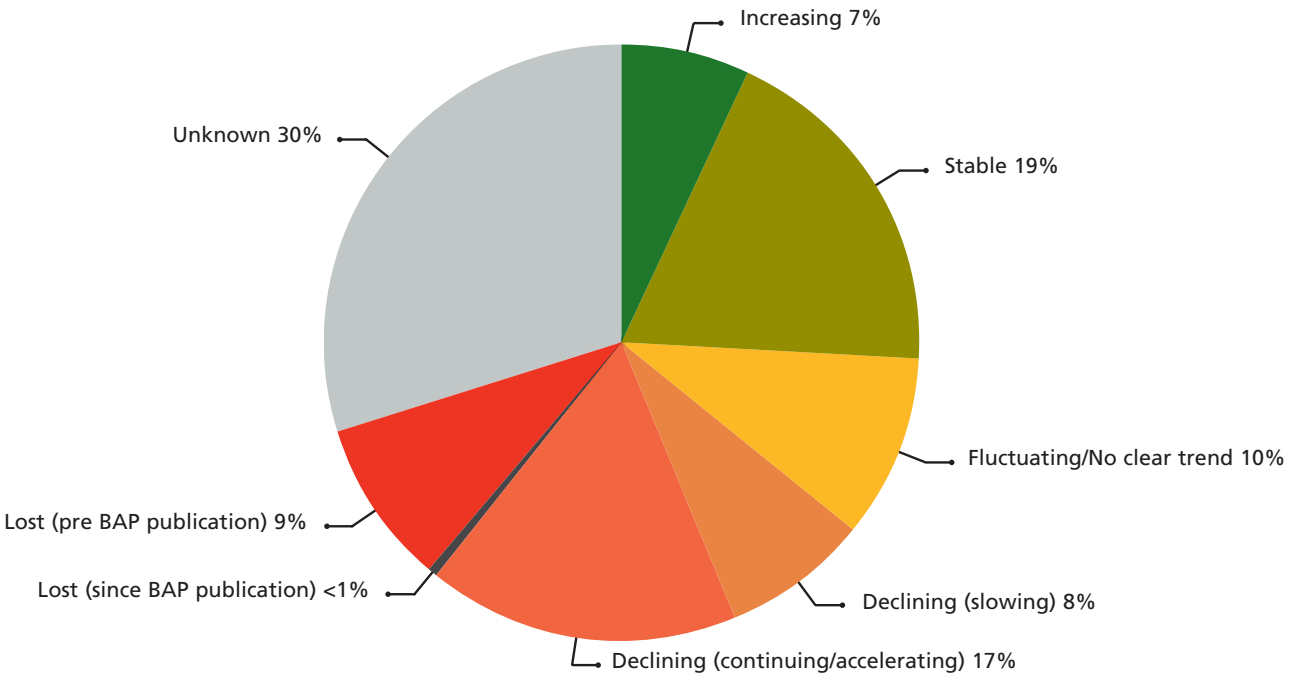
There have been both losses and gains in species in the lowlands in recent years. Changes in species status should be seen in the context of the habitats in which they live. Species conservation is achieved through habitat management, which must take into account the specific needs of a wide range of plants and animals.

Although some species can survive within a single site, such a population is vulnerable to a local catastrophic event, such as severe drought on a wetland site, cutting of the vegetation at the wrong time of year, or fire. Understanding ecological processes and relationships on a scale greater than just the site enables consideration of the wider needs of species. This approach is especially important for species with populations in separated and isolated sites. It can also be used for those species that require several habitat patches within a given area, for example, the marsh fritillary butterfly. In a resilient environment sub-populations of this species will colonise and be lost from a suite of habitat patches in a cyclic fashion over time, as a response to parasite pressure. With increasing fragmentation of habitat patches, sub-populations are less able to move between them and are lost. The eventual result is the disappearance of the species from the area.

The UK BAP 2002 report shows trends for England's BAP species. It demonstrates that there has been a variety of species reactions to conservation measures over the previous three-year reporting period.

Status of BAP priority species in England in 2002[36]

Total number of species: 347



Corn bunting, a declining farmland BAP species.
Nicholas Watts/English Nature

Only one species has become extinct in England since 1995. The starry Breck lichen appears to have been lost from its only site, in Suffolk, probably due to atmospheric pollution and changes in site management. However, the BAP report also shows that 25% of BAP species in England are declining. For species such as corn bunting, pennyroyal and thatch-moss the decline is continuing or accelerating.

In contrast, the decline is slowing for 27 BAP species, including birds such as skylark, mammals such as lesser horseshoe bat and dormouse, and invertebrates such as freshwater pearl mussel, marsh and heath fritillary butterflies and noble chafer beetle. This may indicate that progress is being made towards the targets described within their Action Plans.

Thyme-covered anthill and short sward, Parsonage Down NNR - a nutrient poor habitat.
Stephen Davis/English Nature

Recent evidence[37] shows there has been a decline in the distribution of plants associated with nutrient-poor habitats typical of acidic or calcareous conditions, such as dwarf shrub heath, lowland raised bogs, calcareous grassland, and acid grassland, in contrast to those favouring nutrient-rich habitats of more neutral pH. In addition, taller, shade-tolerant species, favouring more fertile conditions, have been more successful than shorter, shade intolerant species of infertile habitats. Both these results suggest that a major driver of botanical change over the past 40 years has been increasing nutrient availability (eutrophication) across a wide range of habitats.

Furthermore, there have been declines in the plant diversity on nutrient-poor habitats, whereas the number of plant species occurring on improved grasslands, built-up areas and gardens, and broadleaved, mixed and yew woodland habitats displayed a relative increase. The impact of agricultural intensification and afforestation have resulted in the conversion of species-rich plant habitats to comparatively species-poor ones[38]. Trends in these national datasets are supported by evidence from a number of more detailed local studies[39, 40, 41].

High brown fritillary, a rapidly declining habitat-specific butterfly.
Stephen Davis/English Nature

Data from the *Butterfly Atlas* reveal an important comparison between specialist and generalist species[42]. Eighteen 'habitat-specific' butterflies, such as high brown and marsh fritillaries, large heath and wood white, have lost more than 40% of their range at the 10 km square level since the 1970-1982 survey. The habitats they depend on are now restricted to small isolated patches within the landscape, such as ancient woodland surrounded by intensively managed farmland or development. Because these species tend to have poor dispersal ability they are increasingly unable to move between suitable habitat or to colonise new habitat patches should they become available. In addition to the impact of habitat fragmentation, some of these butterflies have also been badly affected by changes in land management, especially the cessation of coppicing in woodlands, and changes in livestock farming.

Marbled white, an increasing generalist butterfly.
Allan Drewitt/English Nature

In contrast, the distributions of most 'generalist' butterflies, such as marbled white, ringlet, speckled wood and comma, have remained stable or expanded. This is because the habitats and food plants of this group of butterflies, for example tall grassland on roadside verges, are still common in the landscape. These butterflies also tend to be mobile species, which are able to colonise available habitat quickly.

There have also been declines in lowland wading birds. These are linked to wetland loss as a result of changes in water level management, and intensification of agriculture [43, 44].

The 2002 UK BAP[45] report states that habitat loss and degradation due to agriculture, changing management practice, and infrastructure developments, were the most significant causes of declines in BAP species and their habitats. However, for 40% of BAP species in England the trend is either unknown or fluctuating. This includes elusive species, and species that need specialist skills to identify them. Lack of information on the status of many of these species is a significant constraint on their conservation. For many species, we also have a poor understanding of their population dynamics, their response to gaps in the habitats they use, and their ability to re-colonise areas of suitable habitat. Examples include the mole cricket, barbastelle bat, tadpole shrimp, royal bolete fungus and the New Forest cicada.

Whilst the BAP report shows that much still needs to be done to meet population targets, there have still been significant gains. 6% of BAP species in England are increasing, including cirl bunting, field cricket, red-tipped cudweed and ladybird spider. There has also been a recent increase in the numbers of dragonflies and damselflies[46].

Our report presents further information in chapter 3 on the achievement of some Habitat Action Plans through successful restoration and re-creation projects. Similarly, many examples of species conservation success stories are also presented in the same chapter.

3 Pressures on lowland nature

Although losses of wildlife in the English lowlands have slowed in recent years, our remaining wildlife resource is still under pressure from human impacts. This chapter examines the interactions between wildlife and the needs of people. For each sub-section, the pressure and its impact on wildlife is described, followed by examples of conservation success where the pressure has been addressed. Each sub-section gives a way forward and concludes with action required to deliver conservation goals.

3.1 Intensification of agriculture

Pressures

Many of our lowland habitats were once integral to mixed arable and extensive livestock farming systems. Grasslands, wetlands and heathlands were grazed, at relatively low intensities, by hardy breeds of sheep and cattle. Increasing specialisation and intensification of agriculture over the last 50 years, in response to developing agricultural technology and policies, have caused a decline in mixed, low-intensity systems. Many of our surviving lowland wildlife habitats are no longer part of the economic farm business, and grazing, which is essential for the maintenance of so many of our habitats, has ceased in some areas, and is difficult to re-establish.

Specialisation

In eastern England, semi-natural grasslands are often isolated remnants within arable farming systems, in which there are no sheep or cattle. By contrast, in the west of England the shift has been towards all-grass farms stocked with high-productivity breeds of dairy and beef cattle that require high-nutrition feeds, and which cannot cope with rough grazing. Species such as the green-winged orchid often decline as a consequence.

Wheat field.
Paul Lacey/English Nature

Green-winged orchids.
Peter Wakely/English Nature 7,323

Decline of green-winged orchids

The green-winged orchid, a characteristic flower of meadows and pastures, was once familiar and widespread throughout the lowlands. Plant atlas and monitoring scheme data show that it has declined steadily over the last 60 years due to the ploughing and improvement of grasslands[47, 48]. It is now restricted to local sites, found in only 29% of lowland 10 km recording squares. The decline in its abundance may be even more severe than suggested by these figures, as the number of populations within each 10 km square also appears to have declined[49].

Once lost, it is difficult to re-establish in new places, even in those that held former colonies, since orchids have very small seeds that only thrive where they can form associations with particular soil fungi. There is very little evidence of this species colonising new sites, so any recovery and expansion will be extremely slow. Protecting the places where it already occurs would have the greatest benefit, rather than allowing further populations to be lost and attempting to re-establish it at a later date.

In addition, there is an increasing trend to produce fodder maize that is of doubtful benefit to wildlife[50]. Payments under the Common Agricultural Policy have accelerated these changes.

Neglect

Without the right kind of grazing, or active management such as scrub control to counter the effects of undergrazing and natural succession, these sites will fall into neglect, causing further decline in quality and the loss of characteristic species. Nearly 17,000 ha of lowland SSSIs in England are in unfavourable condition because of undergrazing[34]. Between 1987 and 1996, Dorset heathlands were lost through scrub invasion at a rate of 1.7% per year[51].

Other habitats formerly within agricultural systems are also suffering from a lack of appropriate management. Many of our surviving hay meadows are very small and isolated, making traditional hay-cutting even more uneconomic. Riverbanks and road verges, which in some parts of the lowlands support a large proportion of the surviving grassland, are often not part of any agricultural management system and are declining in quality. Recent surveys show that they are increasingly dominated by tall herb and scrub vegetation[52]. Other open habitats such as fens and bogs, formerly worked for products such as cattle bedding, thatching material and domestic fuel, are also suffering from scrub invasion. This process is particularly noticeable in wetlands that are drying out due to agricultural drainage and climate change.

Intensification

Increasingly, traditional practices have been replaced by more intensive and cost-effective activities, such as the shift from hay to silage-making

(using faster-growing grasses which require high inputs of fertiliser and frequent cuts). This has resulted in a loss of traditional hay meadows, and their associated flowers. Intensification of arable farming has resulted in massive declines in distribution and abundance of arable 'weed' plants.

Declines in arable plants

Through intensified agricultural management, many arable plants are now confined to the margins of arable fields. Arable plants have been growing with crops for over 8,000 years[53]. Many were common, and some were troublesome to farmers, but they are now the fastest declining group of English plants[54] due to:

- efficient seed cleaning;
- use of herbicides;
- competition from high-nitrogen responsive crops;
- earlier autumn sowing and reduced spring sowing of crops;
- conversion to permanent pasture in western England.

Five arable plants, including the corncockle, are extinct in the wild, and many others are rare. Twelve flowering plants and three mosses reliant on arable land are priority BAP species.

Sown corncockle.
Chris Gibson/English Nature

Intensive management has also resulted in over three-quarters of remaining hedges being trimmed annually[55], which affects their suitability as breeding places for many animals, and reduces the supply of berries to feed birds and mammals[56]. Some river SSSIs are affected by high numbers of sheep and cattle which cause poaching and destabilisation of the banks, leading to erosion and siltation. Pollution of watercourses, lakes and the marine environment results from excessive nutrient and silt run-off, drainage and soil erosion from agricultural land, in both intensive arable and pasture systems. Excessive cutting of riparian and aquatic plants, for fishing, drainage or flood defence, reduces the habitat for water vole, and for invertebrates that are eaten by fish and birds.

Pesticides

The extensive use of pesticides to control crop pests, weeds and diseases has contributed to significant declines in lowland farmland biodiversity[57, 58]. For example, herbicides have contributed to the declines of many rarer arable plants such as cornflower and shepherd's-needle, as well as the more common arable species. Loss of these plants, and the widespread use of insecticides, have also contributed to significant declines in the number and diversity of insects in farmland. Farmland birds that feed on arable plants and invertebrates, such as the grey partridge (where chick survival depends on plentiful invertebrate food in the spring) have declined as a result.

Through their effect on food availability, pesticides may be a factor in the declines of other farmland birds, such as corn bunting, turtle dove and yellowhammer. The wildlife of semi-natural habitats, such as watercourses, woodlands and hedgerows, is at risk from pesticide drift or over-spraying if pesticides are misused.

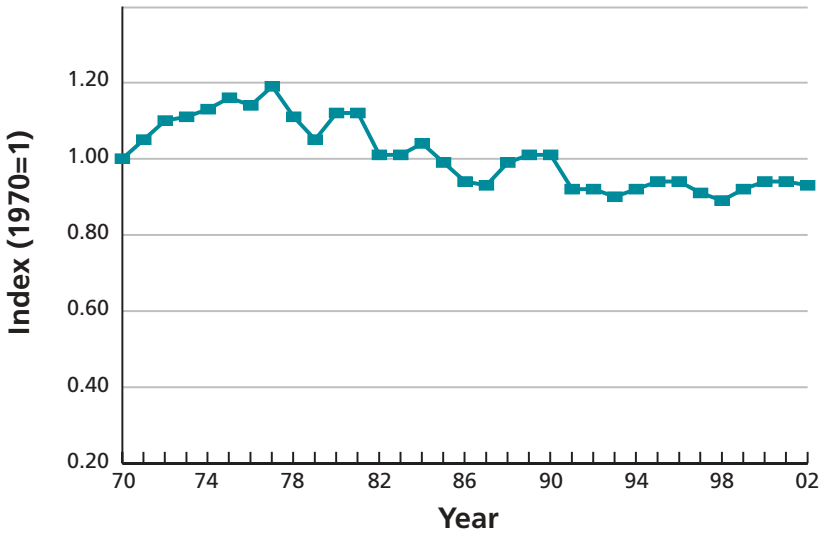
Intensive crop management with pesticides.
Peter Roworth/English Nature

Grey partridge.
Nicholas Watts

Declines in farmland birds

Many once-common and widespread farmland birds have declined dramatically since the mid-1970s. For example, numbers of tree sparrow, corn bunting, grey partridge and turtle dove have all fallen by over 80% in the last 25 years. The Government has set a Public Service Agreement (PSA) target to reverse the downward trend in the numbers of farmland birds by 2020. Progress with this target will be measured using the Farmland Bird Index (based on the populations of 19 species). This has declined by around 40% since the mid-1970s, although it appears to have levelled off in recent years.

Farmland Bird Index for England Source: Defra/BTO/RSPB



The following changes to farming practices have combined to cause these impacts[59, 60]:

- The switch from spring to autumn sowing of arable crops has greatly reduced areas of winter stubbles (which provide spilt grain and weed seeds for winter feeding), and spring tillage (important for nesting).
- The impact of pesticide and fertiliser use has increased.
- Grassland management has intensified, such as the switch from hay to silage.
- Hedgerows, traditional standard orchards, ponds, scrub and other farmland features have been lost or degraded.
- Mixed arable and livestock farming has declined as farms increasingly specialise in arable or pastoral farming.

Studies by the Department for Environment, Food and Rural Affairs, English Nature, RSPB, the British Trust for Ornithology and the Game Conservancy Trust have established ways of increasing bird numbers, for example by increasing seed availability through seed-rich stubbles, and planting seed-bearing crops, now available as options in agri-environment schemes[61].

Reed bunting. M J Hammett/English Nature

The legal use of pesticides approved for use in crop protection causes incidental kills of mammals and birds, through direct exposure to lethal doses, or through contaminated food, although there is little evidence for effects at the population level. Also, local populations of rare species, including some birds of prey, are at risk from the deliberate abuse of pesticides. There is a need for more information on the consequences for wildlife populations of the sub-lethal effects of pesticides, including the cumulative or synergistic effects of different chemicals, in terrestrial and aquatic lowland habitats.

Pesticide poisoning

Persecution, including poisoning by pesticides, is sufficiently severe to restrict the distribution and spread of birds of prey such as red kite and buzzard. Between 1996 and 2002, deliberate pesticide poisoning killed 150 buzzards and 49 red kites in Britain[62]. Recorded incidents may be only a small proportion of the animals killed in this way.

There is growing concern over the possible effects of anti-coagulant rodenticides on birds of prey, particularly red kites. Recent incidents involving the approved use, or misuse, of rodenticides have occurred within the red kite reintroduction areas. Evidence collected by English Nature and the Joint Nature Conservation Committee indicates that around 40% of barn owls[63] and 70% of both kestrels[64] and red kites[65] are contaminated with residues of the second-generation rodenticides. We do not yet know the consequences of such widespread contamination.

Red kites poisoned by rodenticide.
Ian Carter/English Nature

Species Action Plans for arable plants such as cornflower and shepherd's needle, and for bird species such as skylark, tree sparrow and turtle dove, include objectives for reduced use or improved targeting of pesticides. The total weight of pesticides used in agriculture has generally decreased but the area treated, especially in arable crops, has tended to increase[66]. There is some evidence that farmers are reducing dose rates, but this is partly due to greater use of more active compounds, such as the synthetic pyrethroid insecticides, and sulphonyl urea herbicides. Such highly active pesticides have significant impacts, even at low dose rates.

Oilseed rape has been included in the GM crop trials.
David Townshend/English Nature

New technologies

Over the coming years, novel agricultural technologies such as genetically modified (GM) crops will pose additional challenges and opportunities for nature conservation. Genetic modification is potentially a useful tool for introducing an almost unlimited range of new agronomic traits into crops, but commercial development so far has focused on traits that would generally encourage further intensification in farming practices in the UK.

Genetically modified crop trials

The results of the world's largest ecological study comparing two farming systems were published in October 2003. They showed that fields of GM herbicide-tolerant spring oilseed rape, sugar beet and fodder beet managed according to commercial farming practices contained significantly lower numbers of arable plants, seeds, bees and butterflies than the equivalent conventional non-GM crops. The field margins of the GM crops also had less plant cover, fewer flowers, and supported fewer pollinating insects. A third GM crop, herbicide-tolerant fodder maize, contained significantly more biodiversity than conventionally managed maize, but conventional systems currently rely on the harmful residual herbicide atrazine, which is due to be phased out of agricultural use in 2005. The results of these studies will be used by the UK Government in making decisions on whether to license these GM crops for commercial use, but they will also have a wider use in helping us understand the ecological impacts of current farming practices. In the future this kind of comparative research will be increasingly important if we are to improve the overall sustainability of agricultural systems[67, 68, 69, 70, 71, 72, 73, 74].

It seems likely that agriculture will be impacted by a further phase of rapid change, since decoupling of agricultural subsidies from production will free farmers from the need to grow particular crops or operate particular livestock systems, allowing them to grow new crops and adopt new systems in response to market forces. Further economic reforms may curtail production of certain traditional crops such as sugar beet, which could lead to a shift towards continuous stands of winter wheat, and a lack of break crops. Also, new technology, including GM crops, will have unpredictable effects on biodiversity, and climate change may allow, or require, changes in cropping patterns and grassland management.

Conservation successes

Linear farmland features

Restoring cereal field margins through Countryside Stewardship Scheme and Environmentally Sensitive Area payments has been a major success. The UK BAP target for creating 15,000 ha of margins with low-intensity management has been reported as being met nine years ahead of schedule. The majority are grass margins that can be used for nesting and foraging by birds and insects, with relatively few species-rich field margins supporting arable plants. The Department for Environment, Food and Rural Affairs is now examining the value of these newly-created margins for the full range of field margin wildlife.

Cirl bunting.
Mike McKavett/Windrush Photos

Recovery of cirl buntings

Cirl buntings are small songbirds closely related to the yellowhammer. Once widely distributed across southern Britain, their populations suffered a steep decline to just 118 pairs by 1989. The remaining pairs are confined to south Devon.

Cirl buntings need a mosaic of overgrown, bushy hedges for nesting, pastures and field margins rich in invertebrate food for their chicks, and weedy winter stubbles for adult food. In 1994 the Countryside Stewardship Scheme introduced a special project, supported under the Species Recovery Programme by RSPB and English Nature-funded advisers. There are now over 200 management agreements helping farmers provide and manage weedy stubbles and grass margins.

Between 1992 and 1998 there was an 82% increase in cirl buntings in areas with these special project agreements, compared to only 2% in areas with no agreements, and the population had grown to around 450 breeding pairs[75]. A subsequent survey in 2003 found that the population now approaches 700 breeding pairs, exceeding the UK BAP target of 550 by 2003, though it remains confined to south Devon.

Important hedgerows have been protected through the Hedgerow Regulations 1997. These Regulations only cover a proportion of hedgerows, and the Government is considering amendments to extend protection to more hedges, and to protect other countryside features.

Lowland meadows

The Suffolk County Wildlife Site Project shows how agri-environment schemes and advice can deliver farm management that is more sympathetic to wildlife. The project, which is led by the Suffolk Wildlife Trust, started in 1994 and is part funded by local authorities and English Nature. It works with landowners to conserve unimproved lowland hay meadows, which are Suffolk's most threatened habitat[76]. The project is helping to meet Suffolk Local BAP targets by providing advice to owners and managers on grants and agri-environment schemes which are available to help bring grasslands back into positive management, and by developing links with other organisations to help with management and publicity. Other benefits include developing and promoting a grazing register and network, generating interest in flower-rich grassland, and monitoring the condition of grasslands. The project has already resulted in 75% of Suffolk's unimproved grassland County Wildlife Sites being brought back into good condition by 2002, with 71% of the sites eligible for agri-environment schemes having agreements.

Lowland heathland

Through restoration, re-creation, and increasing public awareness Tomorrow's Heathland Heritage is reversing the twentieth century's trend of heathland destruction and fragmentation. This major partnership project, led by English Nature and funded by the Heritage Lottery Fund, was set up in 1997 to tackle the problems caused by lack of awareness and neglect on 31,000 ha of heathland in England. By 2003, 33,800 ha of lowland heathland were being restored as part of the scheme, with a further 2,180 ha having been re-created.

Restoration of heathland, Tomorrow's Heathland Heritage project.
Tom Wall/English Nature

Whilst this project is focused on the lowland heathland habitat, other BAP priority habitats are also benefiting as a result of the landscape approach being taken by the project. These are mainly lowland dry acid grassland, and purple moor-grass and rush pasture. A number of BAP species will also benefit from restoration of managed heathland, and stone-curlew and silver-studded blue butterflies have already shown positive responses. Specific action has been taken within some lowland heathland areas to restore populations of rare species such as the sand lizard.

Reintroducing the sand lizard

The sand lizard has specialised habitat requirements, making it by far the most threatened of England's three native lizards. It is restricted to lowland dry heathland and coastal sand dunes, both of which provide warm microclimates, with excellent ground cover and exposed sand for egg-laying. Its habitat has been lost to development, agriculture, forestry plantation and fires, and many of the patches left are isolated or overgrown by scrub. This caused a population crash, and sand lizards died out entirely in Kent, Berkshire and Wiltshire[77]. Their surviving range is now confined to the heathlands of Dorset and Surrey, and the Sefton Coast dunes in Merseyside.

Efforts to protect, enhance and link existing sand lizard sites include schemes to reclaim heathland from forestry plantations. The Herpetological Conservation Trust, funded by English Nature, is supporting this work through a reintroduction programme. Young lizards, bred in captivity, are released onto newly-created or restored sites that are too far from existing populations to allow natural recolonisation. Monitoring shows that new breeding populations are being established, but this depends on the sites being managed to provide the right conditions. The result is that sand lizards are regaining their former range in Berkshire, Hampshire, West Sussex and Devon.

Sand lizard.
Nick Squirrell/English Nature

Grazing marsh

Agri-environment schemes, including those in Environmentally Sensitive Areas (ESAs), have been crucial for the management, restoration and re-creation of grazing marshes. About 31% of England's grazing marsh is managed under such schemes, with particular successes in north Kent and the Severn and Avon Vales.

Agri-environment schemes to restore and re-create grazing marsh

At St Mary's Hall in the North Kent Marshes ESA, 120 ha of grassland have been created on arable land. Grazing cattle have been reintroduced, ditches re-profiled, and water levels raised. In spring 2002, as a direct result of this work, RSPB counts showed there were 30 pairs of breeding lapwing, 15 pairs of redshank, and eight pairs of oystercatcher, on land that was in intensive arable production only two years before.

The Severn and Avon Vales Wetlands Partnership, established in 2000, involves a range of partners from the environmental, agricultural and planning sectors. In 2000 and 2001 the project secured 19 Countryside Stewardship agreements (Progress Report 2002-2003). These will revert 260 ha of floodplain from arable to permanent grassland, and raise water levels to create 327 ha of traditional grazing marsh. This represents 3% of the UK BAP target, and 54% of the county targets for Gloucestershire and Worcestershire. The 19 agreements will, over the next 10 years, generate over £1.6 million in direct economic benefits for farming and the rural economy.

Other successes

Increase in organic farming

Around 184,000 ha of land in England is fully organic, and a further 68,000 ha are in conversion, the total representing 3% of the total agricultural area in England[78].

Existing incentives include the Organic Farming Scheme, which supports farmers to convert from conventional farming. There is now a substantial body of evidence that organic farms generally deliver more for wildlife than their non-organic equivalents[79, 80]. For example, studies in the Chilterns found corn buttercup, an arable plant which has experienced the most rapid decline of any British plant, in over a quarter of the organic fields in the first year of the study; it was not found at all on the conventional fields. The work showed that organic farms have more wildlife (higher densities and higher numbers of non-crop plants and animals), and a greater variety of wildlife species. Further, the wildlife species that have suffered the greatest declines on farmland in the last 50 years tend to occur more frequently on organic farms.

In addition, the introduction of the Environmental Impact Assessment Regulations in 2002 has the potential for greater protection of uncultivated land and semi-natural areas from intensification of land use. The operation and impact of the regulations are currently under review.

Corn buttercup.
Peter Wakely/English Nature 21,046

The way forward

The Mid-Term Review of the Common Agricultural Policy (CAP)

The reform of the CAP, agreed in June 2003, breaks the link between subsidy and production, and marks a significant change in policies affecting agriculture. A Single Farm Payment will be made to farmers from January 2005, based on farm receipts in the 2000-2002 period. The result will be that farmers will, in future, have much more freedom to follow the market. Impacts on the farmed landscape are likely to be marked, and will vary from region to region. This could have major positive, but also some negative, impacts on achieving the PSA targets for SSSIs and farmland birds.

Spindle, an uncommon species of hedgerows, benefiting from good hedge management. Stephen Davis/English Nature

Less intensive arable cultivation in the lowlands would be beneficial for many farmland BAP species. On the other hand, there may be fewer stock available to graze lowland SSSIs, and less incentive for mixed farming. However, there are the following mechanisms within the reform package with potential to offset adverse environmental impacts. There will be a modest increase in funding for agri-environment schemes, and the possibility of using some of the Single Farm Payments to support environmentally beneficial farming systems. There is protection for permanent pastures, and all farm payments will be subject to compliance with environmental standards. There is also scope for more effective use of set-aside land. A farm advice system will be phased in. Effective monitoring will be needed in order to ensure the new policies deliver the maximum environmental benefits.

Further reform of agricultural and rural development policy at European level is needed. A further switch of funding is desirable from agricultural support to payments for benefits such as enhanced wildlife, landscapes and public access.

New agri-environment schemes

More effective, better-funded, and targeted agri-environment schemes would secure more environmentally sustainable management. The proposed Entry Level Environmental Stewardship Scheme (ELS) will be an important element of these measures. It will be open to all farmers, and will pay for existing wildlife-friendly land management including ongoing support for organic farms, whilst also encouraging new environmental work. Good hedge and field margin management, buffers around in-field trees, practices to reduce soil erosion and pollution of rivers, and seed-rich winter stubble fields and low-fertiliser grassland will all improve farmland wildlife, including invertebrates such as butterflies and bumblebees.

Action for bumblebee recovery

Bumblebees have declined in numbers throughout England, some species by as much as 90% since the 1960s[81]. One species, the short-haired bumblebee, has become extinct in the last 20 years. The causes are complex, but one major factor is the intensive management of semi-natural grasslands, which has reduced the availability of pollen-bearing plants, particularly red clover. Pollen is the food of the bumblebee larvae, so if pollen is scarce, whole colonies die.

Actions taken to reverse the decline include:

- An option within Countryside Stewardship for sowing field margins with a seed mix of pollen-rich plants.
- An advisory leaflet for gardeners and pest-control officers which has raised interest in these familiar insects.
- Research into bumblebee foraging strategies in agricultural landscapes by the Bumblebee Working Group, to improve advice to farmers and gardeners.
- Increased levels of public involvement in monitoring bumblebee recovery throughout England.

The ELS will be complemented by a 'higher level' agri-environment scheme (the Higher Level Environmental Stewardship Scheme), which will focus on more demanding and complex habitat management and restoration. In addition to existing agri-environment scheme objectives of biodiversity, landscape, historical environment and access, the high level scheme will also address resource protection, flood management and genetic conservation. Widespread take-up, and an increase in funding, are vital if the Government is to meet its PSA targets for farmland birds and SSSIs, and many BAP targets.

Bumblebees on a globe thistle.
David Townshend/English Nature

Other issues

Special wildlife sites could be made more relevant to farm businesses and the rural economy through increasing support for organic farming, niche marketing of 'sustainable' livestock and other farm products, and developing countryside tourism and recreation opportunities. The England Biodiversity Strategy's agriculture group is working to convert the outcome of the CAP reform into detailed provisions, with the necessary funding, that will contribute directly to meeting BAP targets.

Better-targeted plant breeding programmes could help the development of farming systems that use lower inputs of agrochemicals, and support more wildlife. There is a need for a better process to determine the impacts of novel crop varieties, and their management, before their commercial uptake by growers. The Forum on Sustainable Seeds for the Environment is developing improved criteria to assess crop varieties, and signals a welcome shift in approach.

Pesticides

Integrated Crop Management techniques, and the pesticide industry's Voluntary Initiative, could play an important role in reducing the impact of pesticides, and encourage farmers to adopt a whole-farm approach to conservation. Crop Protection Management Plans, for example, encourage the adoption of compensatory measures for some of the indirect effects of pesticide use. However, this will depend upon there being sufficient incentive for farmers.

The wildlife impacts of the pesticides used in lowland agriculture are often very difficult to measure. Therefore, as well as dealing with their known effects, we are concerned about the management of risks of pesticides to wildlife. There remain some significant uncertainties about these risks, which need to be addressed through research and the regulatory process. Integrated action, and the adoption of a precautionary approach, are required to reduce pesticide impacts alongside other action at the landscape level to deliver environmental benefits. The proposed national action plan for pesticides provides an opportunity for ensuring the integration of policies and mechanisms to tackle many of these issues.

Action to reduce the impacts of agricultural intensification

Short term:

There is a need to ensure that the reforms introduced as part of the CAP Mid-Term Review, agreed in Luxembourg in June 2003, deliver the best deal possible for wildlife in England. Particular needs:

- Raise the environmental standards of agriculture in the lowlands, through implementing cross-compliance, and defining good agricultural and environmental condition.
- Improve the environmental performance of Set-Aside and the protection of permanent pasture.
- Use 'national envelopes' (money derived from CAP subsidy payments) to improve the environmental performance of lowland agriculture.
- Monitor the effects of various elements of the Mid-Term Review package on farming and the environment.
- Achieve full decoupling of subsidy and production payments.

Develop and roll out the Entry Level and Higher Level Environmental Stewardship Schemes.

Particular needs to address pesticide issues:

- Promote targeted reductions in pesticide use, including greater use of non-chemical crop protection, and greater selectivity in the use of pesticides.
- Introduce a wider action plan for pesticides, to ensure integration with other action for biodiversity on farmland.
- Assess indirect effects, such as changes in food availability for declining farmland birds, as part of the regulatory process for pesticides.
- Improve monitoring of pesticide impacts on species that are not monitored under existing schemes.
- Increase use of no-spray zones for pesticides around sensitive sites and habitats, including strict adherence to Codes of Practice to protect semi-natural habitats.

Medium to long term:

- Develop an effective farm advisory service.
- Gain further resources for land management within the England Rural Development Programme, and ensure that the UK gets a fairer share of funding from the EU.
- Secure greater shift of CAP resources from traditional agriculture subsidies (known as Pillar 1) to the Rural Development Programme payments (known as Pillar 2).
- Reduce diffuse water pollution from agricultural activities.
- Emphasise the economic and wildlife benefits of special sites to the rural community of niche marketing of livestock products, and tourism and recreation opportunities.
- Seek opportunities for continued growth of the organic sector.
- Research the effects on wildlife of new crops and new farming systems, including GM crops.
- Introduce further legislation where voluntary measures are failing.

3.2 Water management

Pressures

'Wetlands' encompass not only rivers and streams, but also lakes and canals, swamps and fens, grazing marshes and raised bogs. More than most other lowland habitats, wetlands are vulnerable to external pressures such as pollution, abstraction and drainage. The health of wetland habitats for wildlife depends not just on site action, but also on the management of the hydrological unit, and often on that of the whole catchment. All wetland habitats are susceptible to invasive non-native plants and animals, largely because water aids the dispersal of these species.

Water quality

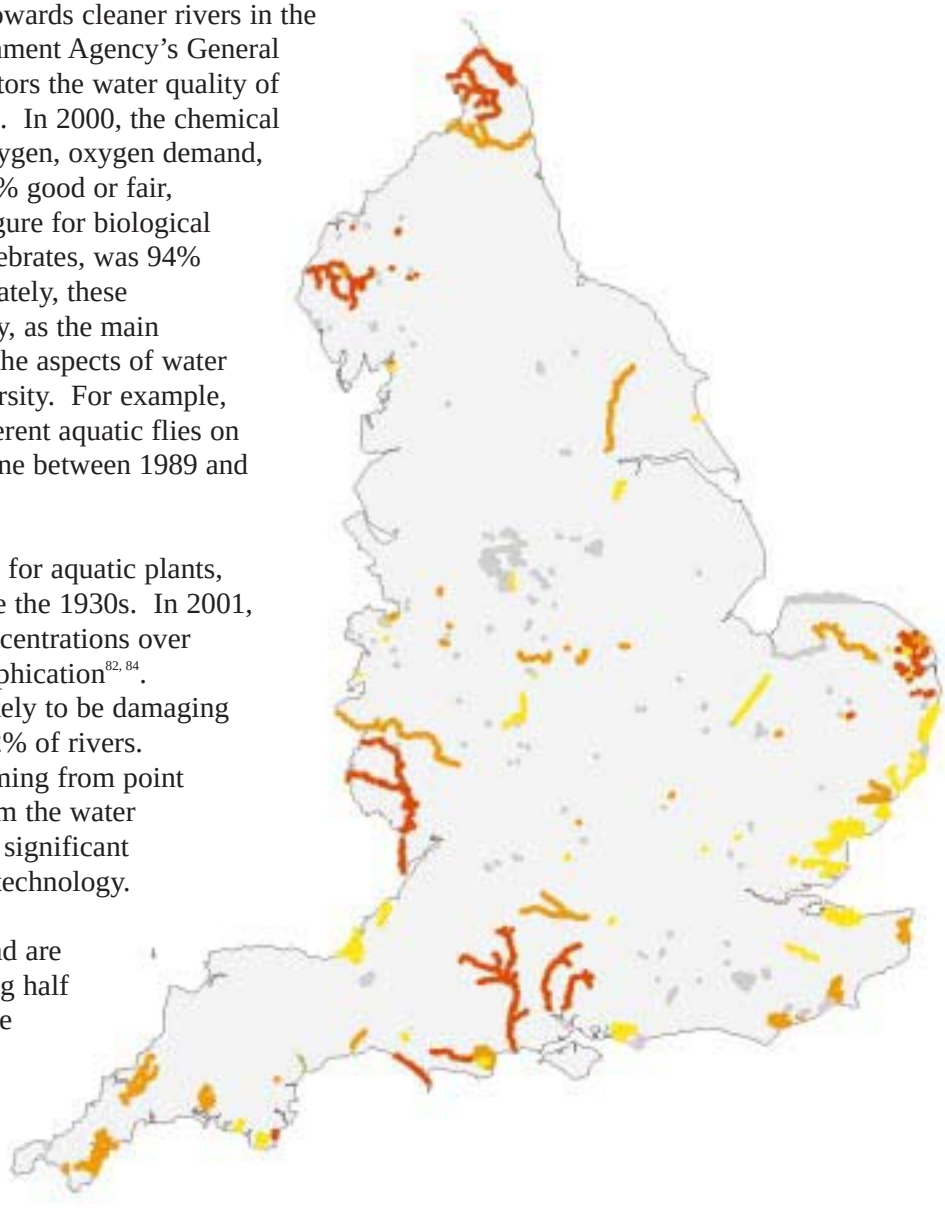
There has been a welcome trend towards cleaner rivers in the lowlands since 1990. The Environment Agency's General Quality Assessment[82] (GQA) monitors the water quality of 40,000 km of river across England. In 2000, the chemical quality (measured by dissolved oxygen, oxygen demand, and ammonia) was recorded as 94% good or fair, compared to 85% in 1990. The figure for biological quality, measured by macro-invertebrates, was 94% as against 87% in 1990. Unfortunately, these statistics do not tell the whole story, as the main GQA measure does not cover all the aspects of water quality that are relevant to biodiversity. For example, a study of the hatchings of 14 different aquatic flies on chalk streams showed a 52% decline between 1989 and 1999[83].

High nutrient levels are a problem for aquatic plants, and have increased 2-3 times since the 1930s. In 2001, 55% of rivers had phosphorus concentrations over 0.1mg/l, the level indicating eutrophication[82, 84]. Nitrate levels over 30mg/l, and likely to be damaging to wildlife, were recorded from 32% of rivers. Half of the phosphorus load is coming from point sources, which requires action from the water companies, notably in the form of significant investment in phosphate removal technology. However, agricultural sources are significant in some catchments, and are contributing much of the remaining half of the overall load. English Nature has identified the 100 SSSIs most sensitive to agricultural diffuse pollution, and a further 100 SSSIs of additional concern.

SSSIs where action is needed to tackle diffuse agricultural pollution

Priority score
Higher score indicates higher priority

- 17 to <22
- 14 to <17
- 7 to <14
- Additional sites of concern



Diffuse agricultural pollution due to run-off from fields into watercourse.
Peter Wakely/English Nature 8,193

Diffuse water pollution from agriculture

'Diffuse agricultural pollution' is defined as all pollution from agricultural land that does not come from a discrete source. This includes livestock manures, pesticides and excessive nutrients, soil washed into streams and groundwater, small discrete leakages from farmyard areas, slurry storage facilities, silage clamps, and yard washings. In addition, there are one-off incidents caused by the disposal of large amounts of slurry or pesticides (particularly sheep dip).

The most widespread impacts come from the effects of soil particles and nutrients (nitrogen and phosphorus). These are lost from agricultural land due to over-use of fertilisers and high levels of soil erosion, and are washed into rivers, lakes, fens, bogs, ditch systems, estuaries and coastal waters. The effects on wildlife are many and varied, and are often very difficult to measure. They include excessive algal growths, loss of biodiversity, and physical smothering of plants and animals.

Water quality monitoring in lakes is less widely undertaken than for rivers, so national trends are difficult to identify. Analysis of fossil diatoms from several English lakes shows that phosphate concentrations may have increased by up to tenfold since the early twentieth century[85]. A study of reasons for the loss of rare stonewort populations in shallow lakes found that eutrophication was the cause of loss in 36% of cases[86]. All lakes act as a nutrient and sediment sink within the catchment, and phosphorus can accumulate in shallow lakes, being continually recycled between the water, plants, algae and sediments. This nutrient enrichment must be reversed by the reduction of nutrient inputs, or removal of phosphorus-rich sediments.

Water quality is also an issue for fens, particularly those in small depressions receiving water from surrounding land. Nutrient-rich, eutrophic fens occur naturally in lowland England, particularly on the lowland river floodplains. However, pollution is now 'enriching' low-nutrient types of fen, such as at Askham Bog in North Yorkshire. Here, the input of nitrogen and phosphorus nutrients encourages the growth of tall vigorous species, such as nettles and reeds, at the expense of those plants that grow in naturally poor nutrient conditions. This pollution threatens to eliminate these fens, including internationally important (Special Areas of Conservation) transition mires and quaking bogs, calcareous fens with greater fen sedge, and alkaline fens.

Other pollutants of concern have sub-lethal effects such as endocrine disruption, although implications for these populations of freshwater species are little known[87, 88].

Water resources

Drainage and water abstraction are drying out many of the wetland habitats of lowland England, and are accelerating vegetation succession from wetland habitats to bracken, scrub and secondary woodland. This is particularly pronounced where traditional management practices such as low-intensity grazing have been abandoned. Formerly large areas of raised bogs, such as Chat Moss in Greater Manchester, have been fragmented and damaged, losing their hydrological integrity.

To restore degraded raised bogs, rainwater must be retained to re-activate peat formation and promote recovery of the structure, fauna and flora. This can be difficult where the natural peat dome is damaged, and the original hydrology of the bog and its surrounding wetland habitats have been destroyed. Restoration may require the reduction or prevention of groundwater abstraction from layers beneath raised bogs (especially where extraction has left only a thin peat residue over a porous sand or gravel base).

Drainage and water abstraction have also resulted in major declines in the populations of wading birds breeding on wet grasslands.

The spangled water beetle *Graphoderus zonatus* is at high risk from drainage or abstraction or local pollution incident, occurring in just one acid pool in Hampshire. Roger Key/English Nature

Lapwing.
Nicholas Watts/English Nature 25,228

Breeding waders lost from England's lowland wet meadows

There has been an alarming decline in the breeding populations of wading birds, such as lapwing, redshank and snipe. Historically, these birds nested on flood meadows in England's lowland river valleys. However, as the countryside dries out, due to the long-term effects of land drainage, and the increased levels of abstraction for crop irrigation, the populations of these charismatic birds are falling[89, 90]. Between 1982 and 2002, 61% of breeding snipe, 40% of lapwing and curlew and 21% of redshank disappeared from lowland wet grassland[91].

Most of these waders now breed on just a handful of key sites, the majority of which are National Nature Reserves (NNRs) or Environmentally Sensitive Areas (ESAs). Between them, the Lower Derwent, Nene and Ouse Washes, North Kent Marshes, Norfolk Broads and Somerset Levels hold 25% of the wet grassland, but support 40% of lapwings, 71% of snipe and 57% of redshank. This shows the success of NNR and ESA management, but highlights the depressing situation outside these areas, where half the wetland sites surveyed in 2002 held no breeding waders.

Successful reserve management methods must be integrated more widely into agri-environment schemes to promote the recovery of these birds. Further measures are needed, even in ESAs, particularly to help breeding snipe, which have specialised habitat requirements linked to water level management. We hope that an opportunity for this will be provided in the proposed Higher Level Environmental Stewardship Scheme.

The characteristics of fens depend not only on water acidity and nutrient content, but also on the water source (surface rain and groundwater). The de-watering of deeper aquifers affects the level, fluctuation and relative contribution of groundwater. Hence some fen types are sensitive indicators of the health of aquifers. The balance between abstraction and recharge of groundwater aquifers is critical for the future of England's internationally important alkaline fens. This is particularly the case for East Anglian fens that lie above heavily-abstracted chalk aquifers.

Abstraction can result in damage to rivers. This is especially serious during times of low flow, when the river ecosystem is already under stress. Abstraction can also cause damage to rivers by reducing high flows, since these flows naturally clean spawning gravels for fish, such as salmon. The sedimentation and erosion processes at high flows are important in the physical structuring of the natural dynamic river.

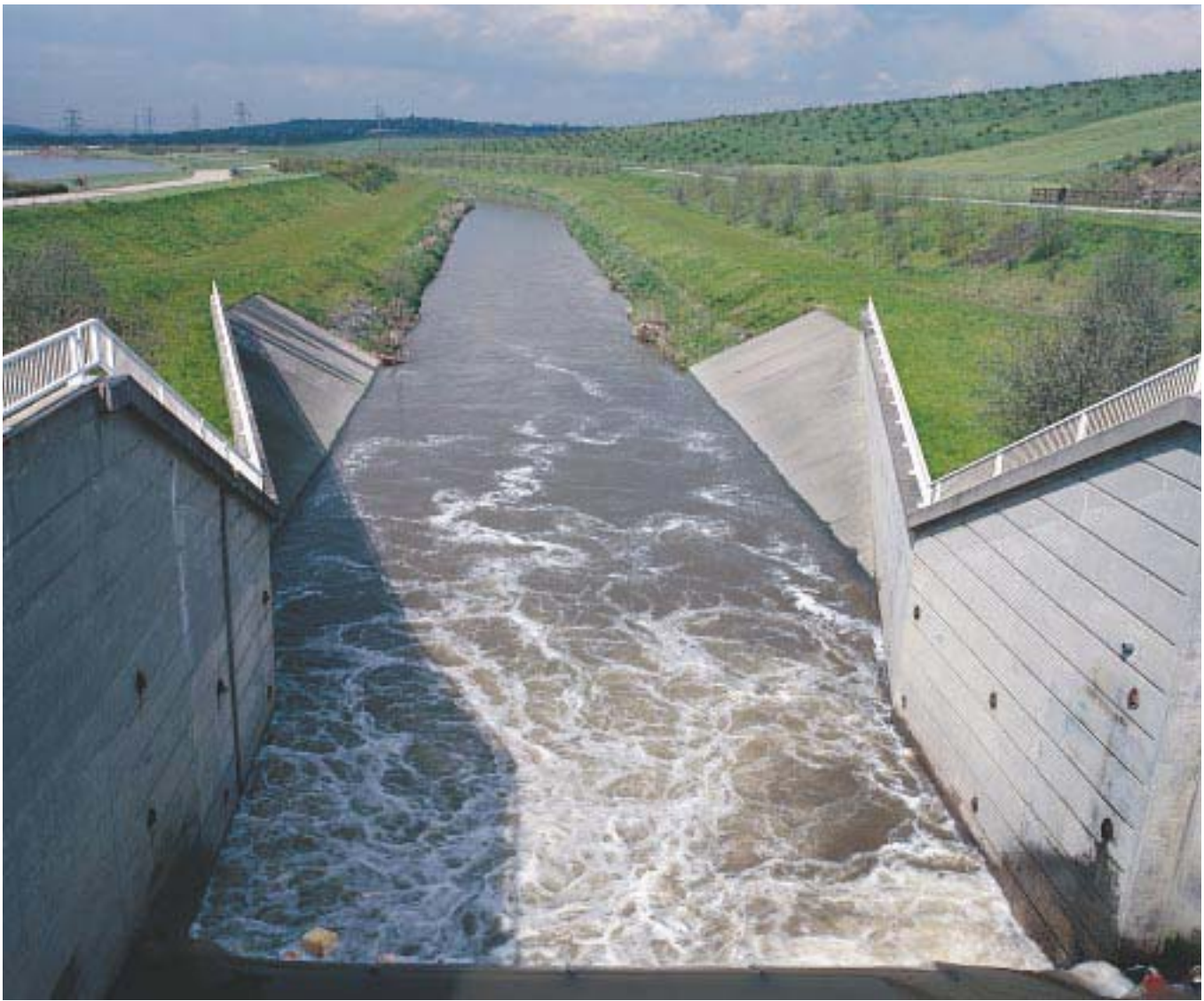
Abstraction can cause rivers to dry up - River Slea, Lincolnshire.
Peter Wakely/English Nature 10,551

Abstraction from surface and groundwater can also affect water levels and flushing of lakes. A lowering of the water table during the wrong time of year can affect plant germination, and available habitat for spawning fish, such as pike. Reduced flushing of a lake will increase the damaging effects of nutrients, and cause algal blooms at lower nutrient concentrations.

Over-abstraction of the aquifer can also change the ratio of the various water sources (surface, ground and rainwater) to a site and thus influence the wildlife interest. Lowering water tables in wet woodlands are threatening the natural understorey vegetation communities and the long-term survival of this vegetation type.

Drainage of wetlands has reduced the capacity of wetlands to act as a sponge, thereby increasing flood risk. Flood defences, built to reduce this risk locally, confine rivers within fixed channels, damaging natural river systems and preventing natural migration of water across the floodplain. The Environment Agency's River Habitat survey[92] showed that 85% of river channels have been straightened or deepened for flood defence, thereby speeding the passage of water to both rural and urban locations at risk from flooding downstream.

Confining rivers to fixed channels speeds the passage of water - River Rother.
Peter Wakely/English Nature 8,183



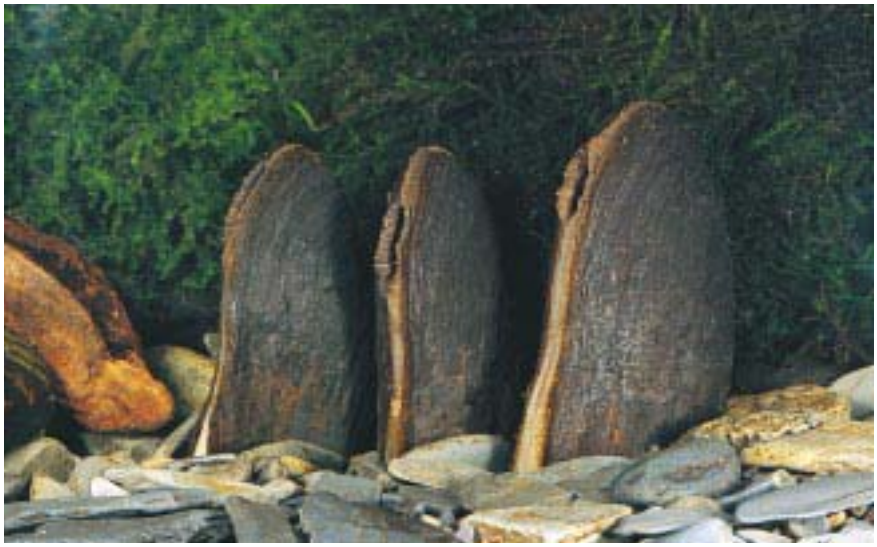
Conservation successes

Rivers

English Nature is leading a four-year partnership project, set up through the EU LIFE Nature fund, to meet the challenges affecting Natura 2000 rivers and their catchments. This £1.5 million project is forging partnerships between landowners, fisheries groups, local authorities, conservation bodies and others with an interest in river management, with the aim of agreeing River Conservation Strategies. It is also identifying the ecological needs of key aquatic plants and animals, and pioneering new monitoring methods and conservation techniques, such as captive breeding of the endangered freshwater pearl mussel. River Conservation Strategies are already in place on a number of Natura 2000 Rivers, including the Avon in Hampshire and the Eden in Cumbria.

River species

Although some river species, including pearl mussels and white-clawed crayfish, have suffered significant reductions in their range, there has been a recent increase in numbers of others, including damselflies and dragonflies[93]. The otter is continuing to expand and consolidate its range, after declining due to poisoning from persistent organochloride compounds in the 1960s and 1970s[94], and efforts to assist the recovery of salmon are under way[95].



Three rare and declining freshwater pearl mussels partially buried in the riverbed.
M J Hammett/English Nature 24,716

Standing open waters

A major project is tackling nutrient enrichment in the Norfolk Broads, but is proving to be a very long-term challenge. By the mid-twentieth century, many rivers and lakes in the Broads had suffered a catastrophic change from clear waters, rich in aquatic plants and animals, to green algal 'soup'. Increasing nutrient levels, particularly phosphorus from sewage treatment works and other catchment sources entering the Broads, caused this change.

The clean-up started in 1977 with improvements to the Sewage Treatment Works in the River Ant and Barton Broad. In 1986 this 'phosphate stripping' was extended to the River Bure Sewage Treatment Works. By 1996 these improvements had cut the phosphorus discharge by 90%. Despite this, the rivers and lakes did not regain their clear water and aquatic plants because sediments on the waterbed had trapped some of the phosphorus. This was recycled back into the water under certain conditions, fuelling algal growth.

In 1995, the ‘Clear Water 2000’ programme was set up to restore Barton Broad by reducing its historical phoshorus load. This project, to suction-dredge the sediment from the lake bed, took several years and cost £1.5 million. Fish were temporarily removed and excluded to encourage the restoration of healthy lake margins. The phosphorus level in Barton Broad is now, after 25 years, down by 80%, but recovery is slow. Clear water, with plant beds, is established in bays behind barriers, and there is an increasing period of clear water in the spring, but the water is still turbid and dominated by algae. The ‘Clear Water 2000’ project demonstrates that although restoration is possible, it is slow and expensive, and prevention is better than cure.

English Nature’s Lakes Restoration Project is also aimed at improving lake quality in the Broads and elsewhere.

Fens

Raising the water levels of fens requires integrated catchment management planning, and co-operation between influential partners. Such partnerships are well-established in areas such as the New Forest, Suffolk and Norfolk, and Cambridgeshire.

The New Forest Sustainable Wetland Restoration project, supported by European funding, is addressing damage caused by past drainage for forestry and grazing, which caused streams to gradually cut back into the valley mires by a process known as headward erosion. The project is raising ditch water levels, and using heather bales to fill in the erosion gullies and trap silt.

Blocked ditch, New Forest mire restoration.
Dave Morris

At Redgrave and Lopham Fen NNR on the Suffolk-Norfolk border, a major project is restoring spring-fed valley fens. The public water supply borehole that was drying them out has now been moved, through a wide-ranging partnership of organisations, and fen restoration is proceeding well.

The Great Fen project in Cambridgeshire will contribute to UK BAP targets for new wetland creation. Deep ditches crossing Holme Fen NNR are part of the local drainage network, serving a wide area of agricultural land. These ditches will be re-routed, and the intensity of drainage in their catchments reduced, to prevent further drying out of the fen. Agricultural land between Holme Fen and Woodwalton Fen NNR will be converted to wetland, to reconnect these two wetland nature reserves.

Konik ponies used to control scrub on Redgrave and Lopham Fen NNR. Peter Roworth/English Nature

Lowland raised bogs

Following its recent purchase of peat extraction planning consents on England's three largest raised bogs, Wedholme Flow, Thorne Moors and Hatfield Moors, the Government has provided funds for habitat restoration. Ongoing works include water level management such as ditch blocking and the removal of scrub.

Agri-environment schemes have also contributed through the creation of fen, reedbed, wet grassland or wet woodland on raised bog margins, to complement on-site works.

The way forward

Despite recognition of wetland problems, action to stem the tide of habitat degradation and species losses from sites has been slow. The table in Annex 1 summarises these pressures and the action underway to resolve them. The five-yearly investment programme by the water companies – the Asset Management Programme (AMP) - is making significant improvements in environmental quality. Under the AMP3 investment period from 2000-2005, 72 SSSIs are benefiting from schemes to reduce abstraction or improve sewage treatment. The Environment Agency and English Nature have recommended that water resources schemes to benefit 53 SSSIs and water quality schemes to benefit 64 SSSIs should be completed during the AMP4 investment period from 2005-2010.

The Environment Agency's ongoing review of consents affecting internationally important wetlands (due to be completed by 2010) should also lead to modification of regulated operations in order to eliminate adverse effects on these sites. In addition, the recently established Water and Wetlands Implementation Group of the England Biodiversity Strategy should help to raise the status of the necessary actions and policy priorities within Government.

Two of the major impacts on wetlands and their wildlife - drainage and diffuse pollution from agriculture - are not subject to regulation. Defra has undertaken a number of initiatives to address these impacts. These include the Diffuse Water Pollution from Agriculture project, and Water Level Management Plans for 500 SSSIs, although only 31% of these have been implemented since their introduction in 1994.

Action to improve the water and wetland environment

Point source and diffuse pollution and abstraction:

- Extend the programme of actions to address the causes of wetland SSSI degradation through the water companies' Asset Management Programme 4 (AMP4).
- Reduce discharges to SSSIs from industry, agriculture and domestic sources.
- Use new abstraction licensing powers in the Water Act 2003 and effectively implement Catchment Abstraction Management Strategies.
- Continue investing in measures to reduce point source pollution, and develop a package of measures to reduce diffuse pollution from phosphorus, nitrogen and silt.
- Review current Water Level Management Plans and fully implement revised plans.

Habitat restoration:

- Implement a significant programme of restoration of rivers, lakes and floodplain wetlands so that they can perform their full range of functions.
- Undertake river audits to identify those most suitable for restoration.
- Re-create floodplain wetlands and wet woodlands to deliver national BAP targets.
- Remove silt from lakes and slow-flowing rivers, as in the Norfolk Broads.
- Raise bed levels of rivers and restore meanders.
- Fund a targeted programme of restoration.

Policy integration:

- Address issues of soil and nutrient conservation, and sustainable water management, through agricultural policies.
- Use a range of policy solutions to resolve issues from the international level (for example CAP reform) to the local level (for example, targeting of agri-environment schemes).
- Integrate policy under the Water Framework Directive, using River Basin Management Plans to provide effective catchment planning for biodiversity objectives.

Buddleia flowers are attractive to native butterflies.
Paul Lacey/English Nature

3.3 Non-native invasive species

Pressures

Many species have been introduced into England from other parts of the world. They include some of our most widespread and familiar plants and animals, such as sycamore, rhododendron, grey squirrel, pheasant and Canada goose. In urban situations, these may offer people valuable contact with nature, as with buddleia which is welcomed as a shrub with colourful flowers providing nectar attractive to native butterflies. These introduced species now form part of England's biodiversity and have spread into our most isolated areas, so that there is unlikely to be a single SSSI without at least one.

Non-native species are introduced in many different ways, both accidentally and deliberately. Early examples include poppies brought in with arable plants when farming was introduced into England, and rabbits introduced for food. Currently, the deliberate release and accidental escape of aquatic garden plants and exotic animals are particularly significant.

Most introduced species either fail to survive in the wild or persist as rarities. Others live in native habitats without causing any threat to our native wildlife. A small fraction (perhaps 0.1%), however, can spread dramatically, increasing in range and abundance to such an extent that they cause marked effects[96, 97]. In some cases they can exist at low levels for some time before they expand to cause problems. Research has so far failed to explain how a species can become an aggressive invader[98]. All newly-introduced species have the potential to become problematic, especially where they can change their habitat preference and behaviour to suit their new home.

There are five main ways in which these non-native invasive species affect our native habitats and species:

Habitat transformation

This is most obvious where introduced plants change the vegetation structure of our natural habitats, forcing out the native wildlife. One of the best known examples is rhododendron, which has spread into many western oakwoods and lowland heathlands. It forms dense stands that shade out native plants, and leaves toxic residues in the soil after clearance, which slows the recovery of native flora.

The introduced Australian swamp stonecrop *Crassula helmsii* rapidly takes over wetlands.
Peter Roworth/English Nature

Freshwaters have seen dramatic transformations with the spread of Japanese knotweed, giant hogweed and Himalayan balsam on their banks, and with aquatic plants such as water fern, parrot's-feather, floating pennywort and Australian swamp stonecrop in the water. These habitats are particularly vulnerable to invasion by non-native species which disperse by floating downstream and spreading in floods, including plants that would not normally produce seed in our climate but can grow from fragments. Such colonisation is often very rapid and difficult to control.

Introduced animals can also transform habitats. Excessive grazing by deer (including several introduced species) is causing problems in woodland, whilst in open waters, bottom-feeding fish such as carp can stir up mud, reducing light levels and changing the plant and animal communities.

Predation

Introduced species of animal can cause rapid crashes in the populations of some of our native animals through predation. Examples include the American mink, which is now widely established in England as a result of escapes and releases from fur farms. It is a specialist wetland predator, and has had catastrophic consequences for the water vole, which is now extinct in parts of its native range. In aquatic environments, introduced fish, like the zander, have caused significant declines in our native freshwater fish.

Water voles have suffered from mink predation.
Derek Middleton/FLPA

Water voles and mink

Water voles favour watercourses with food plants such as reed canary-grass, sedges and bur-reed, in areas where water flow is relatively slow and constant, and where they can burrow into the banks. Water vole numbers have gone through two periods of heavy decline:

- Decline in the 1950s onwards was due to land use changes. Intensive arable farming and heavy grazing encroached on and removed bankside vegetation, poaching of the banks damaged burrows, and hard engineering for flood defence prevented burrowing, and altered the flow and flooding regimes. Suitable habitat became linear and fragmented, and particularly vulnerable to damage that reduced water vole numbers to very low levels.

- With the introduction and escape of American mink in the 1980s, water voles were particularly vulnerable to predation. A breeding female mink and her kits can completely hunt out all water voles in their territory within two years, before moving on to alternative prey[99].

American mink.
Terry Whittaker/FLPA

By 1990 sites occupied by water voles had reduced to only 32% of the number for the period 1900 to 1939[100]. The English population has continued to decline, and is now only 20% of the 1989-90 figures. Water voles now survive where heavy vegetation protects them from predation by mink, or in areas of high water quality where pest control by fisheries limits the numbers of mink.

Hybridisation

Non-native species can threaten the genetic integrity of our native species, which are adapted to survive in their local environment. For example, our native bluebell is increasingly hybridising with the Spanish bluebell, commonly grown in gardens and discarded into the wild. The problem of the genetic impact of non-native species may be exacerbated by the release of genetically modified organisms into the environment.

Disease

Many introduced species bring with them diseases to which they, but not our native wildlife, are immune. The best example of this is the spread of crayfish plague, introduced with the American signal crayfish in the 1970s and 1980s. This has decimated the native white-clawed crayfish population. In other cases, the foreign disease may be spread by native species, as with bark beetles spreading Dutch elm disease, which killed most mature elms in our landscape during the 1970s and 1980s.

Competition

Many native species succumb through competition from more vigorous introduced species. For example, the Asiatic clam was first recorded in the River Chet in Norfolk in 1998, but in just five years has spread to at least four areas in the Norfolk Broads. It forms dense beds, crowding out native shellfish, and its filter-feeding can cause significant changes to the freshwater ecology by removing phytoplankton and other suspended particles. The clam could potentially out-compete our already threatened native mussel species, such as the depressed river mussel.

Conservation successes

There have been many projects aimed at controlling non-native invasive species, and a number of specific examples are given to illustrate this.

Rhododendron control on heathlands

Hardy's 'Egdon Heath' is the largest of the initiatives under the Tomorrow's Heathland Heritage Programme, supported by English Nature and the Heritage Lottery Fund. The project will restore 7,000 ha and re-create nearly 100 ha of heathland. Part of the work is to remove large areas of encroaching rhododendron, following which fencing and cattle grids will be introduced so that local farmers, supported by incentive schemes, can graze their livestock on the heath. This will provide the ideal management to restore a varied vegetation structure for species such as the smooth snake, Dartford warbler and sand wasp.

Large scale removal of rhododendron.
Peter Carpenter

Coypu.
Tony Mitchell-Jones/English Nature

Coypu

Imported for fur-farming in the 1930s, this large South American rodent soon escaped and established populations across East Anglia and beyond, with a peak population of about 200,000 in 1962. Significant agricultural damage then led to the start of control efforts in 1962. A full eradication campaign began in 1981, with the last animal trapped in 1989[101]. This remains one of the few successful examples of the eradication of a non-native species from a large area.

North American bullfrog

This large frog has been found at scattered locations in England, arising from releases or escapes of pets. Predation, competition and pathogen transfer by the frogs pose significant risks to our native amphibians. English Nature has been undertaking control measures at the sole confirmed breeding site, on the Kent-Sussex border. During a four-year programme, over 9,000 bullfrogs have been removed from the wild, and further work will be required in coming years.

North American bullfrog.
Brian Banks/English Nature

Black and brown rats

Across the world, introduced rats have had a major impact on island wildlife, particularly ground-nesting seabirds. On Lundy Island in the Bristol Channel, puffin numbers plummeted from over 3,500 pairs in 1939 to less than 10 pairs in 2000; and there are only 166 pairs of Manx shearwaters compared to an estimated 1,000 pairs in the 1940s. The Lundy Seabird Recovery Project is now working to eradicate rats from the island, using specially designed bait stations. Most rats were eliminated in 2003, and those remaining should be removed during 2004. Monitoring of the recovery of the seabirds is continuing.

The way forward

Through their interaction with native plants and animals, non-native invasive species are causing serious loss of biodiversity in lowland England. In some cases, as with crop diseases, or animals like the brown rat and grey squirrel, they can also have serious economic consequences warranting their control or elimination. Defra recently carried out a review of invasive species and established the costs for the control of some problematic species[102], which run into millions of pounds. In 2000, a study of grey squirrel damage to beech, sycamore and oak estimated the total cost to the British timber industry as £10 million[103]. Lessons learned from attempts to eradicate introduced species such as coypu and the North American bullfrog, support the clear message from the recent Defra review[104]: that measures to prevent the introduction of non-native invasive species are far more cost-effective and environmentally desirable than measures taken after their introduction and establishment.

Action to reduce the impacts of non-native invasive species

- Undertake research into effective control techniques, including monitoring for relevant species.
- Formulate and implement a national strategy to identify the most serious threats and risks, and tackle these in a prioritised way.
- Determine a clear process to establish policies and drive improvements to biosecurity, including better coordination and, species management. A variety of options should be considered including establishment of a new agency or a commission drawn from existing bodies.
- Develop agreed codes of conduct to help prevent introductions, for example, that developed by the Royal Horticultural Society in relation to freshwater plants.
- Revise legislation to incorporate stricter controls on the import and sale of invasive species.
- Devise a targeted education and awareness strategy involving all relevant sectors.

3.4 Inappropriate management of woodlands

Pressures

More than two-thirds of the broadleaved woodland in SSSIs is in favourable condition[105] or under management that should bring it into this condition, but some problems still remain[106, 107]. In addition, the majority of ancient woods lie outside the SSSI series. Although we do not have condition data for these woods, they are subject to the same type of threats and issues as SSSI woodland, at both the site and landscape scale. While large-scale clearances to agriculture have ceased, loss of ancient woodland and veteran trees through small-scale development still occurs.

Many woods are under-managed, and are losing some of their character as a consequence. For example, when open spaces such as rides close over, butterflies, birds and other specialist woodland species may be lost. In wood-pastures, lack of grazing can lead to veteran trees being over-topped by growth of younger trees, which may threaten the survival of species such as oak polypore fungus. Individual veteran trees in hedges or along roadsides are still felled from time to time.

Oak polypore fungus

This bracket fungus lives almost exclusively on old oak heartwood. It is widespread, but never common, on oaks throughout Europe and across Asia. In the UK, only 18 sites have been recorded in the last 30 years[108]. It is found on old living trees, dead standing trees, and sometimes on fallen trunks and branches, but not on young oaks. It is mainly found in our most important wood-pastures, including Windsor Great Park, Calke Park, Epping Forest, Sherwood Forest NNR, Moccas Park NNR, Duncombe Park NNR, Staverton Park, Richmond Park NNR and Ebernoe Common NNR[109].

As with most fungi, the best current management advice for the oak polypore is to maintain current conditions as far as possible. This requires active intervention to maintain the existing veteran oaks, including dead limbs, and retain old fallen oak wood *in situ* indefinitely[110].

Oak polypore fungus. Martyn Ainsworth

The introduced muntjac deer causes damage to woodlands through browsing and grazing.
Tony Mitchell-Jones/English Nature

In stark contrast, overgrazing by deer in the lowlands can cause long-term damage, for example by limiting natural regeneration which ultimately could lead to the loss of these woods. Deer in woodlands also often have a severe effect on the ground flora. At Wytham Woods near Oxford, where deer numbers increased dramatically during the 1980s, permanent plot records from 1974, 1991 and 2000 show the effects on the woodland vegetation and structure[111, 112]. The shrub layer declined from about 44% to 17%; the cover of bramble, on which many small mammals and birds depend, fell from about 33% to less than 5%. Overall, many woodland herbs declined, and the ground flora became grassier through the spread of wood false-brome, tufted hair-grass, and rough-stalked meadow-grass. Deer control measures are now underway, and the woodland is starting to recover.

Woodland compartment fenced to exclude deer, Bradfield Woods NNR.
Paul Lacey/English Nature

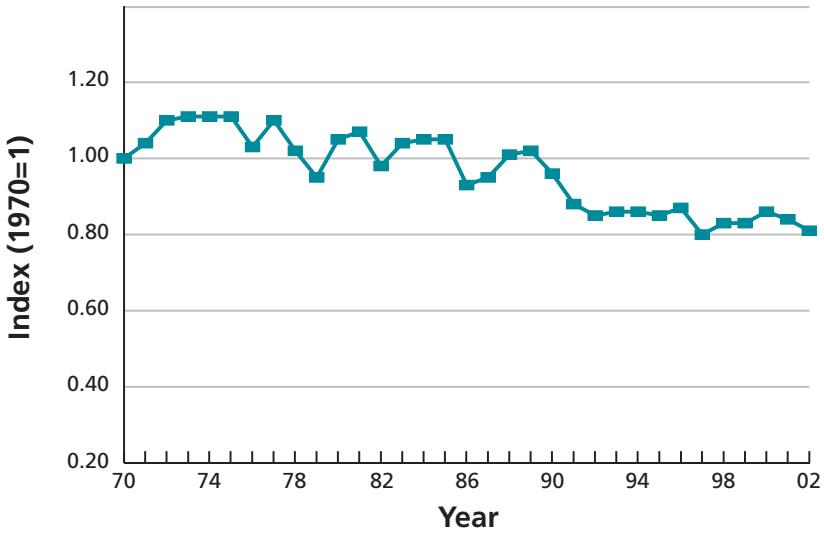
There are similar problems across much of lowland England, and deer grazing is a major cause of unfavourable condition in woodland SSSIs. The flowering of primroses and bluebells can be much reduced, and other species, such as orchids, may be at risk. Young trees are browsed out, preventing regeneration and causing economic damage. Mammals such as bank vole may decline where the ground cover is reduced. Deer grazing has also contributed to the declines observed in woodland bird populations. The SSSI PSA target for woodlands, and various woodland BAP targets, will only be met with increased deer control.

Marsh tit. Derek Middleton/FLPA

Declines in woodland birds

The Government has set a headline 'Quality of Life' Indicator to reverse the decline of woodland bird populations, which have fallen by 20% in the last 25 years. The Forestry Commission has adopted this indicator as one of its performance targets. Progress with this target will be measured by the Woodland Bird Index, which is based on the population trends of 33 species, 18 of which are declining, and include once familiar birds such as the marsh tit and willow tit. Another example is the lesser-spotted woodpecker which declined by 62% between 1970 and 1999.

Woodland Bird Index for England Source: Defra/BTO/RSPB



A large number of factors have been implicated in the declines, all of which could affect the quality of woodland as a habitat for birds. These factors include:

- Competition for food or nesting space, for example, willow tit losing nest holes to blue tit.
- Declining quality of woodland edges due to intensification of agriculture.
- Reduced shrub layer in deer-grazed woodlands which may be affecting species such as nightingale.
- Effects of introduced grey squirrel.
- Factors outside the UK affecting migratory species, such as spotted flycatcher and willow warbler.

More recently the national index has levelled off, although this is due to strong recovery in some Regions (North East, North West, Yorkshire & Humberside and West Midlands) offsetting continuing decline in others (South East and South West). The song thrush, which was declining, is now showing signs of recovery from very low levels, along with species such as the great spotted woodpecker and goldcrest.

A two-year survey of woodland birds, which started in 2003, should provide a much better insight into the pattern and the causes of declines in the key woodland species.

Incentives such as Woodland Grant Schemes support some conservation management, but the current funding is not sufficient for the full range of woodland management needed to deliver our biodiversity objectives. In the past, additional support for management came from the market for timber and other wood-products, but current world timber prices, which set the benchmark for British ones, are very low. The poor economic return from woodland, and high values of farmland, also discourage the creation of new woodland (even with grant-aid), hampering efforts to meet the woodland Habitat Action Plan targets for woodland expansion.

Removal of hedges and field margins next to woods increases pesticide spray drift from adjacent fields into woodland margins. Woods may also be affected more generally by diffuse pollution, nitrogen deposition, and the consequences of climate change, although clear evidence for such impacts is currently limited.

Conservation successes

Forestry support scheme

The prospects for woodland conservation over the last 20 years have improved dramatically with the introduction of the Broadleaves Policy and subsequent improvements to afforestation support schemes. The Forestry Commission's Challenge Fund schemes, including those promoting Coppice for Butterflies, New Native Woods in National Parks, and the JIGSAW programme for linking up ancient woods, have achieved notable successes over the last five years.

Coppicing for heath fritillary butterflies, Ham Street Woods NNR.
Stephen Davis/English Nature

Woodland restoration

Considerable progress has been made towards the woodland BAP targets for restoring native broadleaved woodlands on ancient woodland sites which had been converted to conifer plantations.

Restoring ancient woodlands

Between 1935 and 1985 about 38% of ancient woodland was replanted, often with conifers, reducing its nature conservation interest[113]. Some species survived in rides or gaps, such as the woodland butterflies in Bernwood in Buckinghamshire. Others survived around the edges, whilst at Sherwood Forest, and at Castle Hill, North Yorkshire, some veteran oaks survived within the plantations. The BAP process has encouraged restoration of many of these woods to their former glory[114].

One of the earliest examples of restoration was at Chalkney Wood in Essex, which has an unusual mixture of lime with wet alder flushes. The northern part of the wood was planted with conifers, but many of the original broadleaves survived. Through the efforts of Forest Enterprise the conifers are being removed, and the broadleaves are now emerging from the conifer plantations; the ground flora typical of ancient woodland is also recovering.

Veteran oak, Savernake Forest.
Stephen Davis/English Nature

Wood-pasture

Progress towards the achievement of BAP targets for wood-pasture is encouraging, with widespread recognition of the importance of old trees and dead wood being achieved through the English Nature Veteran Trees Initiative[115, 116]. The needs of wood-pasture systems are now being promoted in agri-environment scheme reviews, and conifers shading the veteran trees are being removed from a number of important sites. Other work includes the development of a database to record the locations of important wood-pastures and parkland, surveys to locate wood-pastures in Staffordshire and the East Midlands, research on the significance of our veteran tree resource in a European context, and restoration of grazing to Epping Forest, Ebernoe Common, Savernake Forest and parts of Windsor Forest.

The way forward

The forestry sector in England, led by the Forestry Commission, has the potential to deliver both a wide range of habitat and species conservation targets, and the broader biodiversity agenda at a regional scale. For example, there are opportunities to promote nature conservation in East Anglia as extensive stands of recent coniferous plantations are being re-structured. The South East and East Midlands have extensive areas of under-managed ancient semi-natural woodland, where traditional management could be restored. Parts of the South West have large areas of relatively young secondary woodland and conifer plantations that can be restored to open heathland. Veteran trees increasingly feature in both national and local policy discussions.

Action to deliver woodland and forestry conservation goals

- Promote sustainable forestry management through better advice on marketing, development of local wood-based energy schemes, the UKWAS certification of wood products, and more direct use of home-grown timber by Government bodies.
- Recognise the value of the Woodland Grant Scheme in supporting the reintroduction of required management within existing woods, and the creation of new woods.
- Promote active management of deer populations across the landscape.
- Improve the surroundings of woodlands to reduce potential off-site impacts.
- Expand the programmes for restoring plantations to appropriate woodland and non-woodland habitats.
- Contribute to broader sustainable development goals through:

  - reduction in our environmental impact on forests overseas.

  - reduction in net carbon emissions.

  - provision of attractive areas for recreation which may contribute to people becoming more supportive of wildlife conservation generally.
- Promote the social and amenity value of woodland to encourage woodland management and expansion, particularly on floodplains and in urban and urban-fringe areas.
- Give forestry, woodland and veteran trees a higher profile in planning and development work through the development of Regional Forestry Frameworks.

3.5 Development

Pressures

Direct losses to development have reduced since the 1980s, due to stronger protection through the regulatory framework, and positive conservation measures[117]. However, the expansion of the road network, new housing, and mineral extraction still threaten semi-natural grasslands, ancient woodlands, heathlands and raised bogs. About 1% of SSSIs, by area, are unfavourable due to construction and development issues. Many non-SSSI areas important for nature are similarly affected or threatened.

Urban development

The pressure from housing construction is set to continue. From 1996 to 2021, the population of England is projected to rise by 3.4 million (6.9%), but the number of households is projected to grow by 3.8 million (19%)[118]. The Government's Sustainable Communities Plan[119] sets out four locations for major housing development: the Thames Gateway, Ashford, Milton Keynes and the M11 Stansted to Cambridge corridor. Urban renaissance to revitalise city centres reduces pressure on the rural areas, but increases the threat to urban greenspace and brownfield sites.

Housing encroachment, Parley Common SSSI.
Peter Wakely/English Nature 10,574

Increased road traffic causes congestion and pollution.
Paul Glendell/English Nature 22,464

Transport

New development inevitably creates demand for new transport, both during and after the construction phase. Transport is central to the sustainability debate. Road traffic continues to grow year on year resulting in congestion, demand for new roads and by-passes (often causing habitat loss or degradation), and pollution from emissions of carbon dioxide, carbon monoxide, volatile organic compounds, nitrogen oxides and particulates. The rapid increase in air travel is creating demand for new and extended airports, and supporting infrastructure. Air travel also creates significant indirect effects, including atmospheric and noise pollution.

The provision of transport facilities for society's needs must be sustainable. A key issue is the cumulative impact of projects already underway, and those that may arise in the future from the Government's 10-year investment plan[120]. There is also poor integration between some aspects of transport. For example, problems in funding rail solutions lead to the progression of road schemes as 'quick fix' solutions rather than as options of last resort.

Landfill

Disused quarries are often used for the disposal of household and industrial waste. Landfill can cause problems such as air and water pollution, and increases in vermin. The breakdown of biodegradable waste produces methane, one of the main greenhouse gases. Cheap landfill also acts as a disincentive to the wise use of resources, making it cheaper to dispose of unwanted goods and materials than to recycle and reuse them. Other problematic after-uses of quarries with nature conservation interest include development for industrial units or housing estates. Concerns over the safety of quarry faces can lead to their disappearance under concrete, netting or buttressing.

Mineral extraction

New development and construction inevitably increases demand for sand, gravel and other aggregates. Specific minerals such as ball clay and china clay are also important in the processing and manufacturing markets. Minerals can only be extracted where they occur in the ground, often causing the loss of valuable semi-natural habitats and geological features. The removal, processing and transport of materials to and from extraction sites also has a range of indirect and downstream impacts. In particular drainage to facilitate extraction, and the disposal of aggregate washings both affect water quality and flow in receiving streams, and noise and dust are also a problem.

Mineral extraction has many impacts.
Mick Murphy/English Nature

The commercial removal of peat for horticultural use under longstanding planning permissions has been a major factor in the destruction of England's lowland raised bogs. These bogs have formed over thousands of years and will not regenerate in the short term.

Former large-scale peat extraction, Thorne Moors.
Peter Roworth/English Nature

Thorne Moors - lowland bog recovering from past peat extraction.
Peter Wakely/English Nature

Conservation successes

Peat

Substantial progress has been made to reduce the impact of horticulture on England's lowland bogs through the Government's recent purchase of peat extraction planning consents on England's three largest raised bogs, Wedholme Flow, Thorne Moors and Hatfield Moors.

However, there is still a significant proportion of consented peat extraction on or next to designated bogs. Actions to conserve these threatened bogs include encouragement for appropriate nature conservation after-use (including the re-establishment of lowland raised peat bog), and initiatives to encourage sustainable horticulture without peat. In the 'Peatering Out' initiative, horticultural consultants are testing alternatives, including recycled green waste, to improve industry confidence in these potential commercial products.

In 1999 only 36% (3.5 million cubic metres) of soil improvers and growing media used in the UK were based on non-peat materials[121]. The target under the lowland raised bog BAP is for this market share to rise to 40% by 2005, and 90% by 2010.

Geological conservation

New advice in the Government's Mineral Planning Guidance has raised the profile of geological conservation amongst planners. Also, the Quarry Products Association, the Silica and Moulding Sands Association and English Nature have signed a Joint Statement of Intent to encourage sustainable development, and have established the 'Minerals and Conservation Forum'. The aggregates and construction company Hanson has also signed a Memorandum of Understanding with English Nature, aimed at ensuring that SSSIs in their care are properly managed.

The minerals industry, in partnership with English Nature, has published two guidance handbooks: *Biodiversity and minerals: extracting the benefits for wildlife* [122] and *Geodiversity and the minerals industry: conserving our geological heritage*[123]. These guide planners, operators and other stakeholders through the planning, operating, restoration and land management phases of minerals working. This will help to minimise the impacts of extraction and maximise the benefits for biodiversity and geology.

The Sustainability Fund, an environmental fund arising from the Aggregates Levy, has provided English Nature with £9 million to distribute as grants for projects tackling the environmental impacts of aggregate extraction. This popular scheme has proved invaluable in supporting biodiversity and geodiversity projects in England, and in encouraging local community involvement. It has awarded grants to 107 projects, including the rescue of a woolly rhino skeleton, believed to be around 40,000 years old, from Whitemoor Haye Quarry in Staffordshire, and support for voluntary groups who are addressing local issues arising from mineral extraction.

Woolly rhino skeleton, found in Whitemoor Haye Quarry.
Dr Simon Buteux, University of Birmingham Field Archaeology Unit

Artist's impression of planned habitat creation at Needingworth Quarry, Cambridgeshire.
Bruce Pearson/copyright RSPB

Habitat creation

Quarries frequently cover large areas, providing plenty of scope to create new habitats through restoration once extraction is finished. This includes opportunities to create some of our rarest habitats, which support our most endangered species, and to promote public access to them. Needingworth Quarry in Cambridgeshire, at just less than 1,000 ha, is an excellent example. An ambitious restoration scheme, the Hanson-RSPB wetland project that was planned before the majority of the extraction programme started, will create a 700 ha suite of wetland habitats including meres, fen and 460 ha of reedbed. This will contribute around 40% of the UK BAP target for new reedbed, and help support birds such as the bittern. 32 km of new public rights of way will give extensive public access. The quarry will be working for around 30 years, but careful planning of the operational and restoration phases allows a rolling programme of restoration to start from an early stage.

The way forward

Building sustainable communities means accommodating development and growth without sacrificing the biodiversity and geological interest of lowland England. It requires the integration of policies across sectors. The planning system is fundamental to the delivery of nature conservation objectives. It sets the policy framework for decisions about the location, scale and type of development, and helps to safeguard designated sites and protected species. Both planning and transport policy must be based on the concept of sustainable development. Recently, there have been some notable decisions reflecting this concept, such as the Hastings by-pass proposal which was turned down on economic, landscape and nature conservation grounds.

The Government is currently reviewing its planning policies for nature conservation (Planning Policy Guidance 9), to ensure that these form part of its commitment to securing development outcomes which integrate social, environmental and economic objectives.

We need a planning system which facilitates legitimate development, ensures protection for important nature conservation sites, encourages sustainable construction and design, and provides planning policies which deliver net gains to our nature conservation resource.

A30 Bodmin to Indian Queens Road Scheme, Cornwall

The proposed alignment for this trunk road is a good example of an innovative scheme to reduce the impact of an existing road to deliver socio-economic as well as environmental benefits. The scheme, if implemented, will provide better public access and more effective management of Goss Moor, a National Nature Reserve of European importance, to enhance the long-term future of the reserve. It has stimulated research into the impacts on marsh fritillary butterflies, and created opportunities to link green travel and tourism initiatives.

A30 trunk road crossing Goss Moor NNR.
Paul Glendell/English Nature 25,493

Action to reduce the impacts of development pressures

Manage development:

- Build environmentally sustainable communities accommodating development and growth which also make a positive contribution to the biodiversity and geological interest of lowland England.
- Implement integrated land use planning with sustainable development principles.
- Ensure sustainable construction and design and provision of accessible natural greenspace.

Reform the planning system to:

- Set out a strong policy framework for decisions about the location, scale and type of development, safeguarding designated sites and protected species.
- Implement the Planning and Compulsory Purchase Act 2001, improve the performance and efficiency of the planning system, and deliver the Government's Sustainable Communities Plan.
- Deliver sustainable development and quality of life for local communities.
- Carry out proper accounting for both direct and indirect biodiversity losses associated with developments.

Transport policy:

- Base policy on the concept of sustainable development, and apply limits to the development of areas of value to wildlife, including designated wildlife sites;
- Integrate all modes of transport and land use, and the planning system, to reduce the need to travel, and to achieve environmental policy objectives.
- Devise imaginative solutions to transport-related problems that result in gains for biodiversity and geology, for example by re-alignment of proposed new routes, or engineering solutions such as cut-and-cover or bored tunnels.
- Apply demand management principles, especially the use of new technologies and charging for the use of infrastructure, with any revenue being used to make significant investments in public transport so that it becomes a viable alternative to car use.

Minerals planning:

- Reduce the impact of mineral extraction.
- Review the minerals planning system, with the aim of minimising adverse impacts and making maximum use of positive opportunities.
- Drive a shift in balance of provision from primary aggregates to other sources, such as recycled and other alternative (more sustainable) materials.
- Continue to make full use of the Aggregates Levy Sustainability Fund.

3.6 Atmospheric pollution

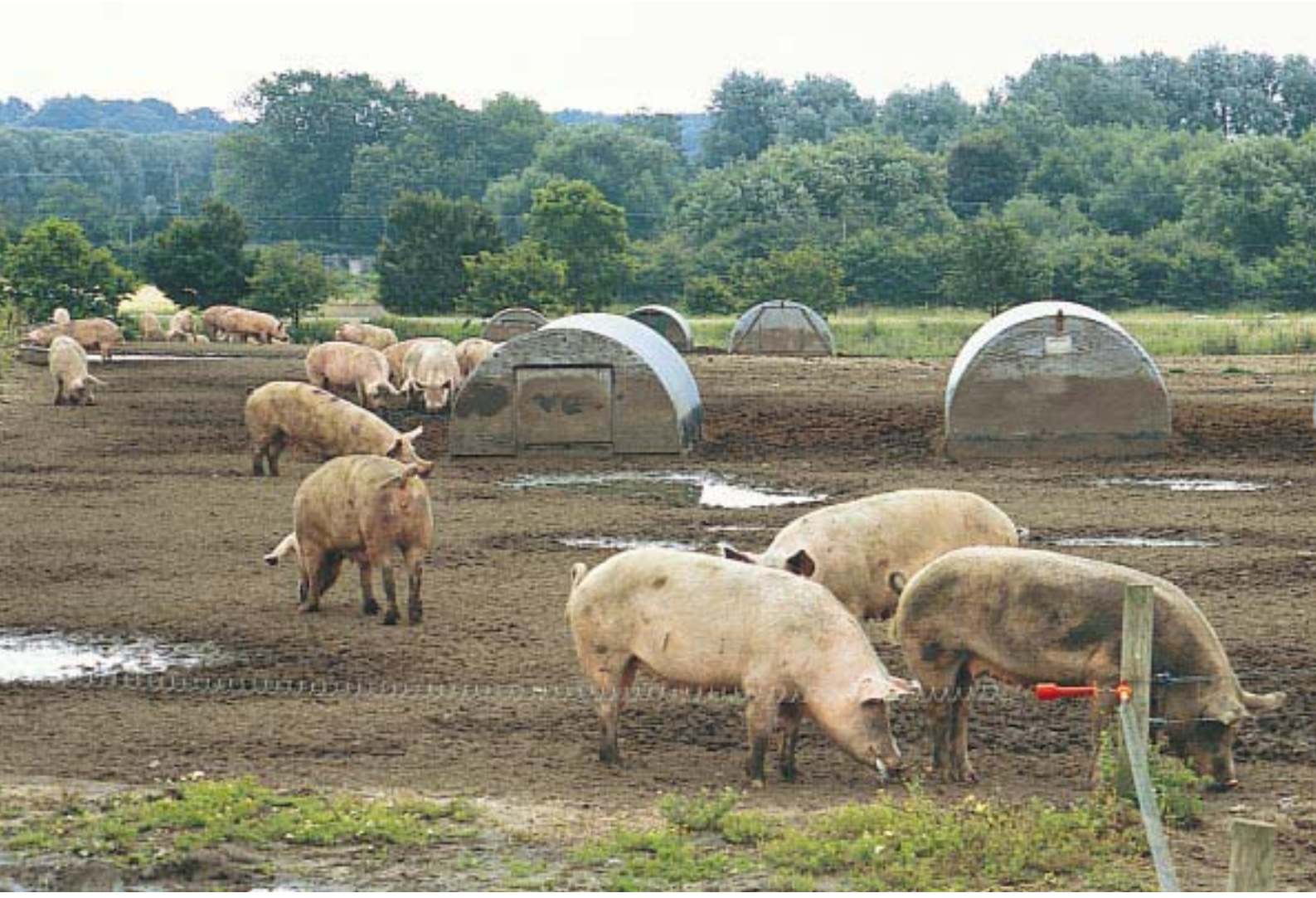
Pressures

The past few decades have seen large changes in air pollution levels in lowland England. There have been substantial reductions in the emissions of sulphur dioxide (80%) and oxides of nitrogen (40%) from their peak[124]. Since sulphur dioxide pollution has declined, the main problems for semi-natural ecosystems are ground level ozone and nitrogen deposition. Close to major roads and urban areas the problem is concentrations of oxides of nitrogen, and close to intensive livestock units it is concentrations of ammonia.

Nitrogen

Nitrogen deposition remains a major threat to semi-natural ecosystems, most of which are characterised by low levels of nutrients. It can affect them in a variety of ways from subtle changes in diversity to direct toxicity[125].

Extensive livestock systems produce lower concentrations of ammonia.
Peter Roworth/English Nature



The major sources of nitrogen oxides are emissions from industry (40%) and traffic (45%), whereas agriculture is the major source of ammonia (>80%)[126]. Ammonia is an increasingly dominant component of the total nitrogen deposition in England. Large areas of semi-natural ecosystems in lowland England exceed 'critical loads' (internationally agreed thresholds for nitrogen deposition above which there may be harm to the ecosystem)[127]. This suggests that there are risks to semi-natural ecosystems from current rates of deposition.

Nitrogen is thought to be slowing or preventing the recovery of lichens that followed the reduction in sulphur dioxide concentrations. In many rural areas lichens are still in decline, and diverse lichen communities are being ousted by a few species tolerant of high nitrogen levels. Research in the Netherlands[128] suggests that the main nitrogen source is agricultural ammonia, which can disperse over long distances. Nitrogen has direct impacts on species such as the brown beard lichen *Bryoria fuscescens*, which is very sensitive to ammonia.

Nitrogen deposition also has more subtle and indirect impacts, through the acidification and nitrogen enrichment of soils. This can change the interactions between plants in favour of widespread competitive species, increase the susceptibilty of plants to other stresses, and have direct effects on very sensitive species. Experiments show that these changes can occur at deposition rates even lower than those presently experienced in England.

Although soil acidification from nitrogen and sulphur compounds is generally reducing, it remains a problem in some lowland areas where soils are poorly buffered against the acid inputs. Some freshwaters are still affected by historical or ongoing atmospheric sources of acidification.

The increased growth of competing vegetation in areas of formerly impoverished soil is believed to have contributed to the recent extinction of the starry Breck lichen. High levels of nitrogen deposition are also implicated in declines of richness and diversity in semi-natural grasslands, and may be having a significant and long-term effect on lowland heathlands.

Ozone

Ozone is a secondary pollutant formed by a complex series of reactions involving nitrogen oxides and volatile organic compounds in the presence of sunlight. There are large daily, seasonal and spatial variations in ozone concentrations[129]. Peak levels usually occur in late spring or summer. However, there is evidence of elevated concentrations in early spring and winter, and this pattern is increasing[130]. Experimental evidence suggests that concentrations currently experienced in England are detrimental to the growth and physiology of many native plants[131]. There is a need for more research that uses more natural and realistic conditions to improve understanding of this threat to biodiversity.

Conservation successes

Sulphur dioxide

Sulphur dioxide was responsible for a large-scale loss of sensitive lichens in urban and industrial areas throughout England. It also suppressed the growth of *Sphagnum* bog-mosses on blanket mires by increasing the growth of competitive plants like purple moor-grass. However, the significant reduction in concentrations of sulphur dioxide has largely removed the threat to ecosystems, except in large industrial areas.

Lichens are now re-colonising our biggest cities after an absence of over 100 years. Roadside trees in suburban Birmingham are once again well covered with lichens. In Regents Park, London, the British Lichen Society recently found 31 species on trees that 20 years ago held only one or two[132]. However, other factors may also be involved in this recovery. There is some evidence in cities that increased levels of dust, much of which is alkaline, can neutralise sulphur dioxide thereby masking the effects of high atmospheric levels.

The way forward

The UK Government is committed to further reductions in the emissions of sulphur dioxide, nitrogen oxides, ammonia and volatile organic compounds under the EU National Emissions Ceilings Directive[133], and the United Nations Economic Commission for Europe's 'Gothenburg Protocol'[134]. In addition, the new regime of Integrated Pollution Prevention and Control[135], and new obligations on the pollution regulators from the EU Habitats Directive, provide mechanisms to address some impacts from large industrial and agricultural point sources through consultation on important nature conservation sites.

Lichens are now recolonising our cities:
Above - *Xanthoria parientina* (yellow) and *Physcia adscendens* (grey). Rene Larsen
Below - *Parmotrema chinense*. Rene Larsen

Action to reduce the impacts of atmospheric pollution

Secure further, more targeted reductions in the emissions of sulphur dioxide, nitrogen oxides, ammonia and volatile organic compounds under the EU National Emissions Ceilings Directive, and the United Nations Economic Commission for Europe's 'Gothenburg Protocol'.
In particular:

- Reduce diffuse pollution especially emissions of ammonia.
- Promote national and international measures to reduce emissions of precursor gases, and thereby reduce the impacts of high ozone concentrations.
- Ensure that the Air Quality Strategy contains a clearer policy and strategy towards reducing exceedance of critical loads, and provides protection to ecosystems by ensuring that the national objectives for the protection of vegetation apply to all SSSIs.
- Address the impacts of air pollution on nature conservation sites from large industrial and agricultural point sources, through consultation on Integrated Pollution Prevention and Control, and the Habitats Regulations. Promote site-specific risk assessment to fully evaluate potential impacts on nature conservation sites.
- Promote research to refine targets and standards for nature conservation interests, in order to develop bio-monitoring methods to assess impacts of air pollutants on nature conservation sites, and to evaluate the impacts of air pollution on the SSSI series.

3.7 Climate change

Pressures

Natural climate change has affected the world for millions of years. However, the rate of change increased dramatically during the twentieth century, with warming significantly exceeding any natural variations in climate over the previous 1,000 years. This coincided with industrial and social development increasing the level of greenhouse gases in the atmosphere, and accelerating natural processes. The 1990s was the warmest decade on record.

This trend is set to continue for much of the twenty-first century, even if there is global stabilisation of greenhouse gas emissions. Average temperatures across England[136] may rise between 2.0 and 3.5 ^{o}C by the 2080s, depending on future emission levels, with parts of the south east being up to 5 ^{o}C warmer in summer. This will bring changing rainfall patterns and higher frequencies of extreme weather events, such as storms and floods. Sea level will continue to rise as higher temperatures cause continental ice-sheets and glaciers to melt and seawater to expand.

Flooding at Upton-on-Severn.
Paul Glendell/English Nature 25,065

Cross-leaved heath could decline if climate change causes drying out of its wet heathland habitat.
Paul Glendell/English Nature 25,599

There is already clear evidence of the effects of climate change on England's characteristic plants and animals, including changes in populations, ranges, migration patterns, and seasonal behaviour such as the time of plants' flowering and birds' nesting[137]. These effects are likely to become more apparent and extensive as climate change continues, with expansion in range of some species, local extinctions of others, and habitat change becoming increasingly common.

Research shows that climate change presents threats to some species and their habitats, and opportunities for others. As warmer temperatures spread north, species with northerly distributions will be most vulnerable to the loss of suitable 'climate space', losing ground to southern species able to expand their ranges. Because species will respond in individual ways, the composition of habitats will change, creating new mixtures of plant and animal species.

The ability of some species to expand or shift their range in response to climate change is limited both by their mobility and by the availability of suitable habitat in the areas where the climate might be favourable. In our highly fragmented landscapes, there is now little suitable habitat to allow natural migration. The formerly extensive functioning ecosystems of the lowlands have been damaged or destroyed, so that our protected sites and other wild spaces are left as islands. The intensive land use between these islands will probably be a significant barrier to the natural movement of species and habitats in response to climate change. Species will be particularly vulnerable where there is little or no overlap between current and possible future distributions, and where dispersal ability and habitat connection are poor.

Conservation successes

The multi-partner research programme known as MONARCH (Modelling Natural Resource Responses to Climate Change) evaluates the likely impacts of climate change on England's plants, animals and habitats, and the functioning of ecological systems over the next 50 years[138]. Despite uncertainties about many aspects of future climate and biological responses, there are some tentative conclusions based on detailed computer modelling:

Predicted response of habitats and species to climate change

Wet heathlands: Low rainfall and increased rates of evaporation in summer may dry out many wetland habitats. In south east England, wet heaths could revert to dry heath or acid grassland. Cross-leaved heath, currently found throughout Britain, may give way to bell heather.

Woodlands: Beech is drought-sensitive, and may die back as soils become drier in summer. By the 2050s, parts of southern England may no longer support beech woodlands in their current form. Drought-tolerant trees such as yew could expand their ranges.

Grasslands: Plant species whose northern limit in England is limited by summer temperatures may spread northwards. These might include dwarf thistle and yellow-wort, species characteristic of calcareous grasslands. Spanish catchfly, currently confined to the dry grasslands of Norfolk and Suffolk, could spread in the south east as England warms and dries.

Birds: Species from southern England should fare best. The reed warbler should prosper as suitable conditions expand into southwest and northern England. The nuthatch is already expanding its range, and may spread even further north and west given sufficient mature broadleaved woodland to support new populations.

Beech woodlands may not survive climate change.
Stephen Davis/English Nature

The way forward

Our research has highlighted important immediate and longer-term challenges for nature conservation. The resilience of the countryside must be improved to accommodate the effects of climate change on both habitats and species. Protected sites will have a crucial role to play but, in addition, effective ecological links between areas of semi-natural habitat will be essential to facilitate the movement of species through what are currently fragmented landscapes. These challenges can be met by developing a dynamic, flexible approach to nature conservation management, both within special sites and in the wider countryside[139], by demand management, and through a creative approach to development control.

Actions to reduce the impacts of climate change

- Monitor population changes in vulnerable species.
- Re-connect habitats across the countryside.
- Examine the implications for and develop nature conservation policy as necessary, especially for designated sites and for species that have poor dispersal ability.

3.8 Recreation

Pressures

Increasing numbers of people are turning to all parts of the countryside for recreation, and to enjoy the scenery, fresh air and healthy exercise. Each year, 80 % of adults who visit the countryside do so for pleasure[140]. Of these, 23% visit at least once a month, and a further 14% at least once a week. SSSIs play a major part in this recreation, providing a resource for people to have contact with nature, and sustaining tourism and the rural economy. Research undertaken in 2003 revealed that there are 370 million recreational visits to SSSIs annually, involving 40 different recreational pastimes[173]. The role of SSSIs will increase under the Countryside and Rights of Way Act 2000, which introduces a statutory right of access to open country (comprising mountain, moor, heath and down), and registered common land. Maps showing open country and registered common land reveal that 524,000 ha of this is SSSI. Hence SSSIs, which cover less than 8% of the country, will provide over 50% of the access land.

Our wild places and protected sites also have a very significant economic role. RSPB research shows that the Leighton Moss nature reserve attracts 100,000 visitors a year, bringing an extra £950,000 into the local tourism economy[141]. They estimate that nature helps to support the national rural tourism market (totalling £12 billion a year), and supports 18,000 full-time equivalent jobs. Regional economic studies also indicate the importance to the rural economy of jobs in environmental protection. In the North West Region, over 100,000 jobs are sustained by industries that protect, manage or promote the environment. This is 5.6% of employment, bringing in 2.1% of the regional Gross Domestic Product (GDP)[142]. Figures for the North East are 51,666 jobs, 6% of the workforce, bringing in 5% of the regional GDP[143].

Visitors are welcomed to National Nature Reserves, North Meadow, Cricklade NNR.
Stephen Davis/English Nature

Tomorrow's Heathland Heritage, guided tour.
Steve Clarke/English Nature

English Nature welcomes access to the countryside for quiet enjoyment, healthy recreation and for the benefit that people get from contact with nature. However, in some areas public pressure can cause problems for sensitive features and species, through damage to plants and soils from trampling and erosion, deterioration of water quality in lakes, rivers, canals and streams, and localised disturbance from access, noise and artificial lighting. Breeding birds, such as nightjar, are particularly sensitive. Public access and disturbance are responsible for unfavourable condition on 73 SSSIs covering 5,000 ha[34].

Effects of recreation on key species

English Nature has commissioned research on a number of species thought to be vulnerable to access, including woodlark, nightjar, Dartford warbler, stone-curlew, reptiles and amphibians. This has revealed extremely complex relationships between access and breeding success. For example, provisional data shows that woodlarks nest at lower densities on heavily used recreational areas, but have larger territories, resulting in a much higher hatching success and growth rate. Consequently, the number of fledged young is virtually identical in areas with high visitor numbers (and low nest density), compared with areas with low visitor pressure (and high nest density).

For other species, predation, sometimes following disturbance by dogs, may be the most important factor limiting nesting success. Nightjars, for example, are well camouflaged on their nests. When dogs scare them off the nests, their marbled white eggs are very obvious. Predatory crows, watching from key look-out trees, swiftly move in to take the eggs.

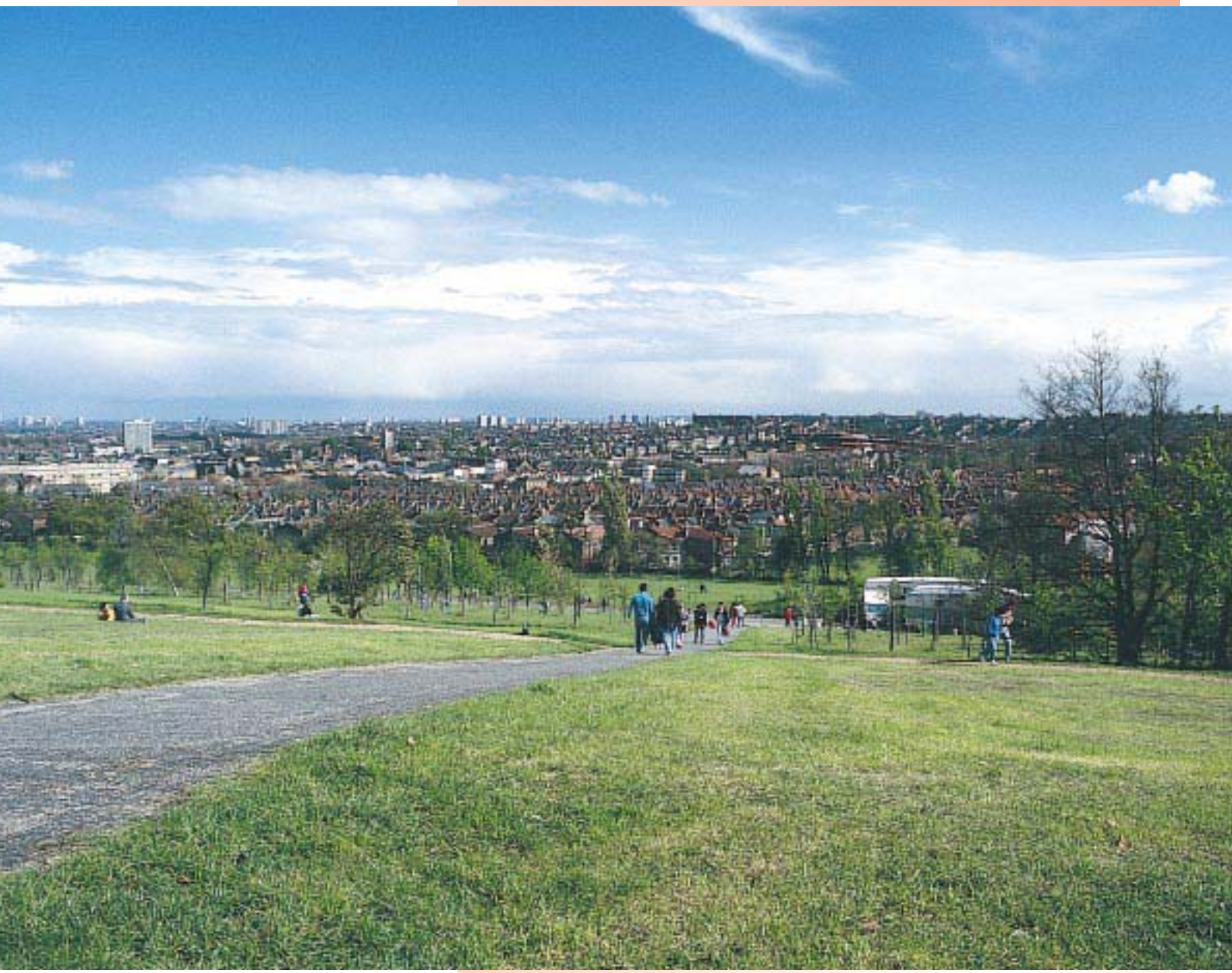
Ground-nesting nightjars can suffer from disturbance.
M J Hammett/English Nature

Feeding stations not only help birds but also provide enjoyment for humans.
Paul Glendell/English Nature 23,056

Conservation successes

Gardening for wildlife has become a popular activity, especially in towns and cities. In a survey carried out in 2000, 56 % of people surveyed had regularly done something to encourage wildlife in their garden, 66% had regularly avoided using pesticides, and 33% had regularly avoided buying products causing damage to wildlife[144]. The provision of nestboxes and bird feeding stations is widely used as a way of attracting and enjoying garden wildlife.

Since most people in England live in towns and cities, urban habitats are particularly important for providing contact with wildlife. English Nature's Accessible Natural Greenspace Standards set a benchmark for the provision of such contact. We are working in partnership with other organisations to develop guidance on assessing and improving the quality of greenspace, as there is considerable scope to improve the wildlife value of parks and other urban greenspaces for the enjoyment and conservation of nature.



Accessible natural greenspace at Muswell Hill, London.
Paul Lacey/English Nature

English Nature's Accessible Natural Greenspace Standards

People living in socially deprived inner urban areas tend to have least access to safe local green spaces. At the same time, they are less able to travel to distant parks and the countryside. Accessible Natural Green Space Standards, if adopted, would improve access for these people.

English Nature recommends the following minimum standards[145] for the provision of natural greenspace close to where people live in towns and cities:

- accessible natural greenspace at least 2 ha in size should be available within 300m (in a straight line) of all urban homes;
- accessible 20 ha site within 2 km;
- accessible 100 ha site within 5 km;
- accessible 500 ha site within 10 km;
- 1 ha of Local Nature Reserve per 1,000 population.

Urban SSSIs and Local Nature Reserves (LNRs) have an important role in demonstrating the value of wildlife sites, and their contribution to people's health, well-being and quality of life. The number of Local Nature Reserves has increased over the past ten years from 336, with an area of 14,000 ha, to 965 covering 25,000 ha[146] .

The New Opportunities Fund provides funding for the'Wildspace!' Grants programme, administered by English Nature, on LNRs. This includes support for Community Liaison Officers to help people to discover and enjoy their local natural areas. These initiatives often attract new people into conservation, and provide access and education opportunities for disabled people and socially disadvantaged young people.

Greener spaces for better places

Middlesbrough is one of the ten most deprived boroughs in England, with unemployment at twice the national average. Access to the countryside is not an affordable option for thousands of families.

Over the next few years, Middlesbrough Council's 'Wildspace!' project will work to ensure that every resident will be within 1 km of an LNR, bringing the benefits of attractive natural greenspace within easy reach. Stainton Quarry and Linthorpe Cemetery have already been declared as LNRs, and two more reserves are planned.

The 'Wildspace!' Officer offers walks, talks and training opportunities, and provides links with local schools, community centres and libraries to draw in more people, and encourage them to use and enjoy these reserves. Through involvement in planning and care of the reserves, the project will promote wider engagement of local communities in improving their local environment.

Many other sites outside the SSSI series have scientific and educational value. Geological sites can now be protected as Regionally Important Geological or Geomorphological Sites (RIGS), selected by local voluntary groups of amateur and professional geologists working with local authorities. English Nature has a Memorandum of Understanding with the Association of UK RIGS Groups, recognising the increasing value placed on geological conservation, and the mutual benefits of working in partnership.

The way forward

There are many opportunities for mutual benefit to wildlife and people through improving access to wildlife. For nature conservation, increased opportunities to experience wildlife and geological features can improve understanding and appreciation of these features. This helps to increase support for conservation issues in general, and has significant potential to contribute directly to the delivery of BAP targets. Examples include 'visitor payback' schemes, which can raise funds for environmental improvements, and new recreational developments which, if sensitively sited, can be designed to maintain and enhance existing wildlife habitats.

Activities are zoned at Rutland Water reservoir.
Anglian Water

Integrating recreation and conservation

Rutland Water reservoir, which is an SSSI, a Special Protection Area and a Ramsar site, is a prime example of the effective zoning of a large area of water to accommodate sporting, recreational and nature conservation interests. The nature reserve at the western end of the lake is managed by the local Wildlife Trust on behalf of Anglian Water, who own the reservoir. Water sports and other recreational activities, such as cycling, take place away from this area.

Where research shows that important species or habitats are sensitive to access, English Nature works with relevant recreational groups to find ways to accommodate them, and overcome any conflicts. In many cases this can be through the management of access, such as careful siting of car parks, gates, paths and stiles, supported by a range of interpretation techniques to explain the issues.

Action to reduce the impacts of access and recreation

- Improve understanding and appreciation of wildlife and geological features, in order to increase support for conservation issues, and contribute directly to the delivery of BAP targets.
- Improve public access and interpretation on National Nature Reserves.
- Increase tourism and recreation partnership projects.
- Research and implement ways to overcome conflicts between access and sensitive habitats and species.
- Encourage active participation in nature reserve management and in surveys of local wildlife.
- Zone areas with high wildlife and recreational value to manage potential conflict.
- Develop partnership projects to create new wildlife areas for people to enjoy.

Lack of management leading to invasion of heathland by pine trees.
Isabel Alonso/English Nature

3.9 Deteriorating wildlife site quality and habitat fragmentation

From this examination of pressures on our wildlife resource in the lowlands, two major issues emerge - the poor quality of wildlife sites (through either too intensive management, or neglect) and fragmentation of habitats.

Deteriorating quality of wildlife sites

Intensive land use

As we have shown, our natural resources are now heavily exploited for agriculture, forestry and development. These uses have not only direct impacts on our wildlife, but also a range of indirect effects, including diffuse pollution, aerial pollution, nutrient enrichment, and the disruption of hydrological regimes.

Neglect or insufficient land management

In contrast to the pressures from intensive land use, some parts of the lowland wildlife resource, notably woodland, heathland and grassland, are suffering from insufficient land management, even neglect. This lack of management is often the result of changing economics that mean that many of the sites no longer fit with modern agricultural and forestry regimes.

Many of the wildlife habitats in urban and developed areas are also suffering from mis-management and neglect, because of their isolation from agricultural systems. Debris, dumped rubbish and vegetation obscure abandoned urban quarries and neglected sites. On-site effects may be compounded by changes in the use of the surrounding land.

Fly-tipping at the edge of a wildlife site.
Paul Glendell/English Nature 25,410

Pollution and combined effects

A number of wildlife sites and species suffer from a combination of factors. There are many examples, such as those sites located on the urban edge, where the pressures of atmospheric pollution are compounded by management neglect. Other examples include sites that require grazing, but which are located in largely arable areas where there are too few grazing animals, or which suffer periodic flooding by nutrient-enriched water.

Moss hangs on by a thread

The slender thread-moss, only 1 cm high, is a UK BAP species and a European Red Data Book species.

A systematic survey of all historical locations began in the late 1990s, including a review of over 340 museum herbarium specimens. This survey revealed that the moss still occurs in England, but in only four of the 16 counties in which it was once recorded, its stronghold being the High Weald in Sussex.

This dramatic decline is due to a combination of factors, including loss of its sandstone outcrop habitat and neglect, with trees and invasive shrubs being allowed to shade it out. Also the related Cape thread-moss introduced from South Africa, has rapidly colonised such sandstone outcrops to the detriment of the slender thread-moss. Pollution, including acidification and nutrient enrichment, is compounding the damage, probably tipping the balance against the native British species.

Research into the interaction between slender thread-moss and its invasive relative is providing information on genetic diversity between and within populations. As an insurance against further losses, slender thread-moss plants are now held in culture at the Royal Botanic Gardens in Kew, and reintroduction trials are planned. Its future remains uncertain.

Slender thread-moss.
Ron Porley/English Nature

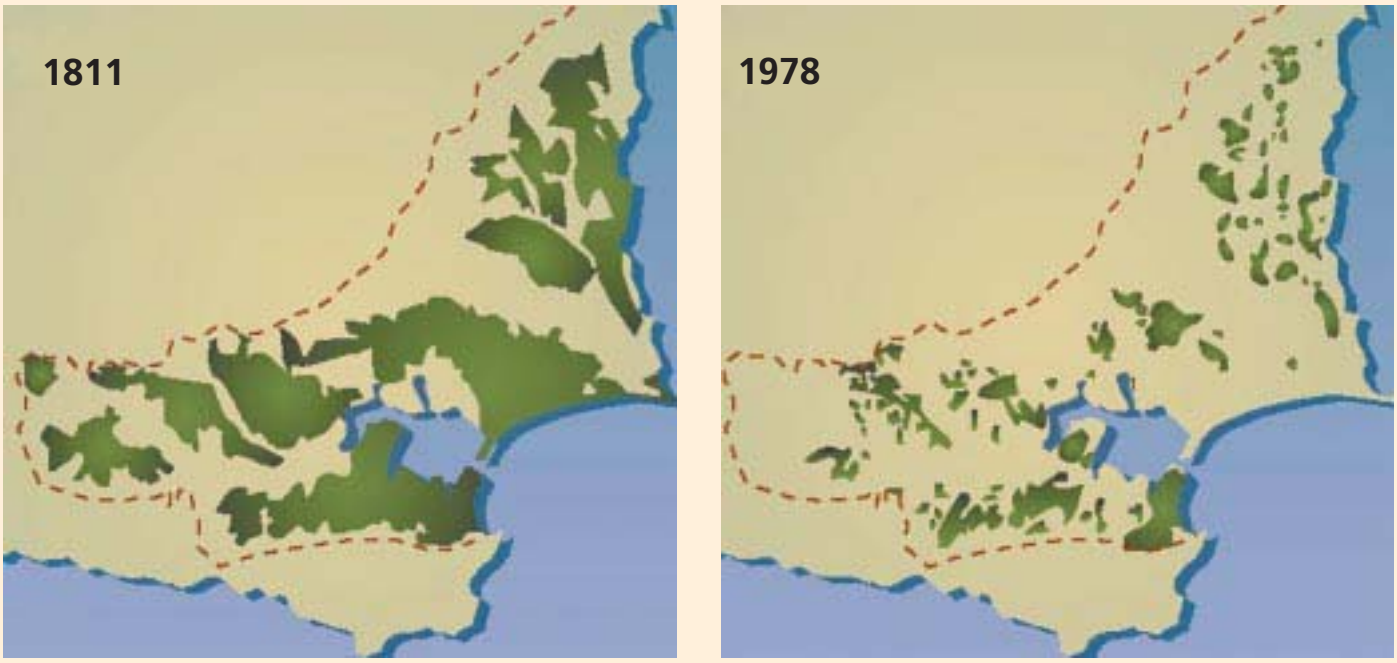
In many cases it is difficult to separate the effects of different impacts when monitoring sites, and it is likely that chronic declines arising from, for example, diffuse pollution are being masked by more immediate problems such as undergrazing. In other cases, effects may not yet be manifest as changes in site condition, but deterioration is likely if measures are not taken to prevent further deposition or loading.

In many cases, deterioration in habitat quality is measured by decline in, or loss of, the species typical of that habitat. For example, both intensified management (with high fertiliser application) and neglect (leading to rank sward and scrubbing up) result in the loss of the diverse flower-rich swards of lowland grassland.

Habitat fragmentation

Through the steady loss of wildlife habitat over the years, lowland habitats have been broken up from their original whole into smaller unconnected pieces. This is known as habitat fragmentation. It is particularly evident for grasslands and heathlands, and the remnants of wildlife-rich habitat within highly developed urban areas.

Decline in Dorset heathland



The loss and fragmentation of Dorset heaths between 1811 and 1978, due to agricultural intensification and housing.

Fragmentation of habitats has three serious knock-on ecological effects: severance, shrinking size, and isolation.

Dorset heathland now fragmented by housing developments, Parley Common SSSI.
Peter Wakely/English Nature 10,579

Severance and habitat simplification

Our major habitats were once integral parts of large functioning ecosystems. Habitat destruction has dissected ecosystems so that individual blocks of habitat no longer grade into each other. In addition, their hydrological continuity has been disrupted. The remaining areas are generally small and isolated, in landscapes of intensively farmed land, interspersed with urban settlements and industrial developments, all set in a web of transport corridors.

Shrinking size

As natural ecosystems have been destroyed, the size of individual sites has fallen. Smaller areas have greater edge-to-area ratios, making them more susceptible to external influences or 'edge effects'. Small sites gradually lose their characteristic species, because their populations are too small to survive periodic catastrophic events like unfavourable weather, fires, floods, disease and excessive predation, or the 'natural' fluctuations inherent in any population. Many of these areas are now too small to sustain their habitat in the long term. As yet we do not have a clear understanding of the minimum viable areas for our habitats, or the minimum viable population size for vulnerable species.

Isolation

Wildlife sites that are shrinking in size become increasingly isolated from each other. As the distance between sites increases, the quality of the intervening land assumes increasing significance. Land that is intensively managed, or heavily developed, usually excludes the wildlife that used to thrive there. Land that has lost landscape features like hedgerows, ponds, ancient trees, copses and ditches, reinforces isolation and creates a hostile setting that prevents species moving between habitats.

Great crested newts need farmland 'pondscapes'

Newts need ponds for breeding but spend most of their lives on land, finding food and shelter in pastures, hedgerows, dry stone walls, grass margins of arable fields, scrub and woodlands[147]. Groups of populations near clusters of ponds survive better than isolated populations. A pond-to-pond distance of less than 500 metres is best for their dispersal and long-term survival.

Great crested newt. Jim Foster/English Nature

Newts have declined due to the loss of suitable ponds, which have suffered a 33% decline since the Second World War[148]. This loss, from about six ponds per km^2 pre-War to 1.7 ponds per km^2 now, has increased the distance between ponds[149], and hence their isolation.

Isolation has profound impacts on species that need a network of closely connected sites to survive. Some species have different needs at each stage in their life cycle. Some are adapted to pursue temporarily favourable conditions in a succession of sites whilst others, such as the marsh fritillary butterfly, use a network of closely located areas where each individual site is too small to support the species on its own in the long-term. Any loss within this network can affect the species, even where the site is not currently occupied, because it limits available habitat for re-colonisation. Sites in poor condition within this network may also be more vulnerable to species extinctions, and also act as a 'sink' for dispersing individuals. These effects will assume increasing importance as species need to respond to climate change.

Marsh fritillary butterflies need a network of nearby sites.
Stephen Davis/English Nature

Social and economic impacts of habitat fragmentation

Fragmentation of habitats not only affects wildlife, but also has implications for people. A landscape of disconnected habitat fragments is unlikely to have the aesthetic appeal that comes from more extensive swathes of habitat, and the opportunity for recreational enjoyment of a tract of semi-natural countryside is reduced. In such a fragmented landscape it is increasingly difficult to escape from the impacts of human activity. Fragmented sites lose their historical context, and their association with past landscapes and traditional land use.

Fragmentation also has implications for nature conservation management. With small, disconnected patches of semi-natural habitat, the cost per unit area of securing good conservation management increases, and the likelihood of success decreases. Furthermore, the difficulty of maintaining small sites in the longer term becomes an operational constraint, and deters owners from regarding themselves as effective conservation stewards. Fragmented wildlife sites are also more susceptible to a range of external factors, such as changing air quality, climate change and nutrient enrichment. As a result, the fragmented and isolated wildlife remnants are increasingly vulnerable to permanent damage and degradation from these pressures, bringing about further loss of habitats and species[150].

Action to reduce impacts of habitat deterioration and fragmentation

- Reconnect existing wildlife habitats, and restore hydrological connectivity through habitat creation.
- Increase size of existing habitats to reduce ‘edge effects’, and to allow species to survive catastrophic events.
- Improve the management of existing habitats, and carry out large-scale habitat restoration to increase the network of suitable areas within the landscape.
- Develop an integrated approach to habitat conservation which considers habitat mosaic and landscape context, rather than individual habitats.

4 Future lowland landscapes for wildlife

4.1 Current state

England is internationally renowned for its diverse lowland landscapes, yet we have shown that:

- Lowland England has suffered significant habitat loss in the twentieth century.
- Losses in extent of semi-natural habitats due to agricultural intensification have largely ceased within the last 20 years, but losses due to development still continue.
- The habitats that remain are typically very fragmented, and isolated within intensively-managed landscapes.
- Many lowland habitats are in poor condition due to a range of pressures, notably lack of appropriate management, water quantity and quality problems, atmospheric pollution, climate change, and the effects of invasive species.
- Many formerly common and widespread species are no longer common, nor widespread.
- Natural processes on which people and nature depend are being disrupted.

4.2 Landscape-scale approach

Much is already being done to address these issues, including stronger legislation, and more focused use of other mechanisms such as agri-environment schemes, and the UK BAP process. All these are delivering real wildlife gains and a considerable reduction in the rate of habitat and species loss.

In spite of this positive action, it is clear that a site-based approach alone will not meet England's national and international obligations for the conservation of habitats and species, or many of the targets set under the UK BAP and the Public Service Agreements.

Designated sites must continue to be defended and managed not only to protect their special interest, but also to act as wildlife refuges as they are the core areas for the subsequent recovery and re-colonisation of land between these special sites. Similarly, populations of rare species must be maintained and, where possible, increased, since these populations will serve as reservoirs for future expansion. We must, therefore, improve the quality of the environment around and between protected sites to allow this to happen. Working at a landscape scale will support the protected sites themselves, sustain the wildlife outside them, and allow natural movement across landscapes in response to inevitable climate change and human pressures. In order to improve the wildlife fabric of the whole landscape, increase its quality and resilience, and restore the ecological

A diverse chalk downland landscape - Perry Court organic farm.
Stephen Davis/English Nature

processes that support life, a wide range of individuals and organisations need to be involved. A good example of how landscape-scale considerations can be used to help formulate a shared action plan is the LIFE ECOnet project being carried out in Cheshire.

LIFE ECOnet: corridors, networks and barriers

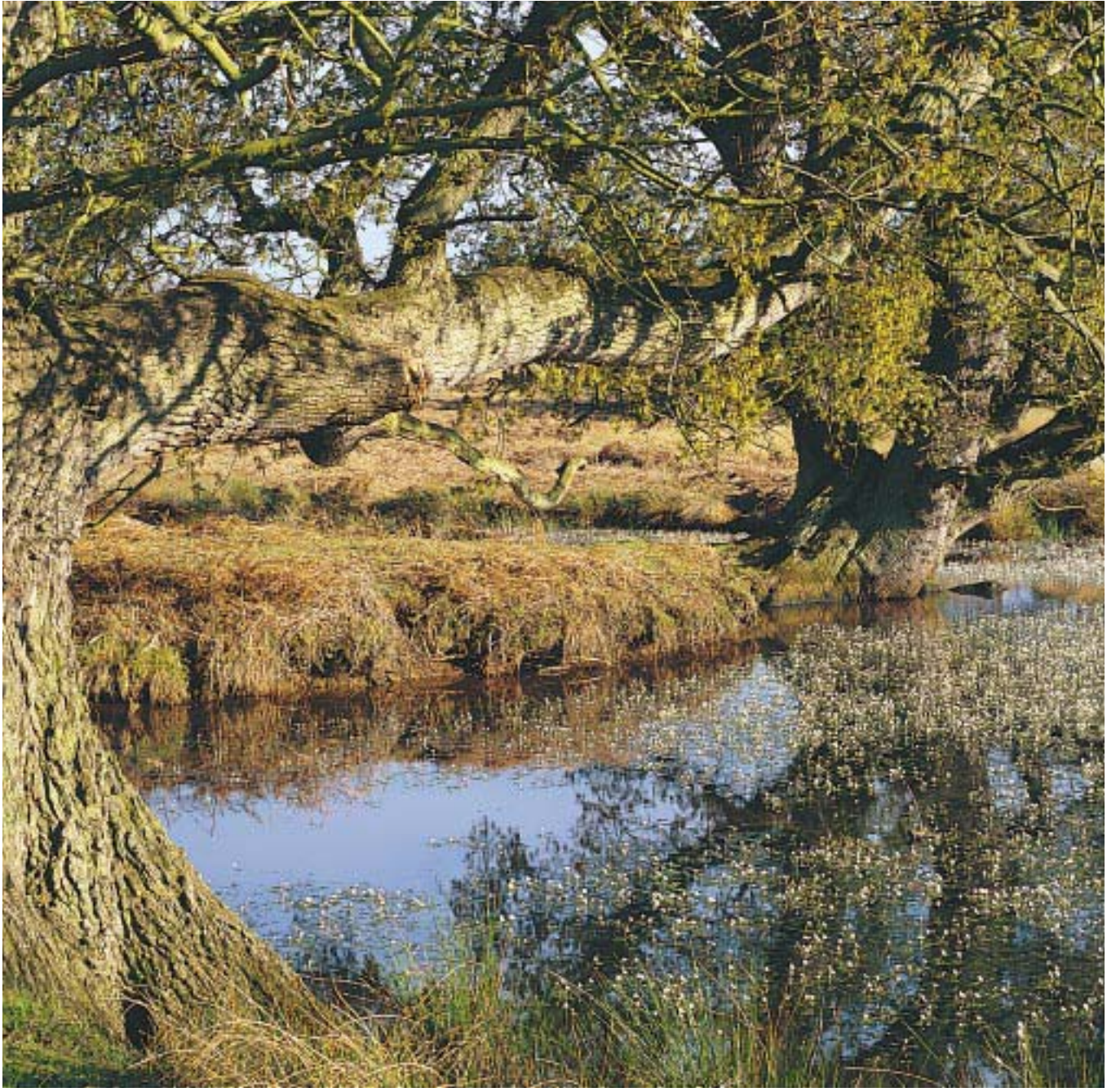
ECOnet is a European LIFE-Environment funded project, led by Cheshire County Council[151], which has explored how to improve the pattern of habitats at large scales. A partnership of local authorities, Government agencies, practitioners and research centres from the UK, Italy and the Netherlands developed a series of models to identify options for future land use. The outputs will help local authorities and others to integrate environmental issues into land-use planning and management.

The project has used GIS data on habitats and species to model how the current pattern of habitats and land use supports or prevents species dispersal. Existing semi-natural habitats have been mapped, and other areas identified that could link these habitats and allow species to move between them. In three study areas, a wide range of local people and groups have worked together to restore or create suitable habitats in the network, using existing sources of funding. The project has successfully encouraged the adoption of this idea of ecological networks within sustainable development strategies and planning policies in north west England.

The combination of species and habitats in the whole landscape and the ecological processes that support life constitute the ecosystem. Many ecosystems provide services essential to our continued well-being, such as flood prevention, coastal protection, water supply and storing atmospheric carbon. However, when excessive demands are placed on an ecosystem, these services can be disrupted or altered. The consequent social and economic problems can be difficult and expensive to address. There is a growing recognition that our remaining natural resources have a limited capacity to accommodate change, and if they are to be used and managed sustainably, we need to operate within these limits. This is known as ecosystem management, and this concept was incorporated within the Convention on Biological Diversity as a framework for guiding appropriate action at large scales. In the majority of situations, management of the whole landscape or catchment is essential to maximise the social and economic benefits that can be obtained through sustainable land use[152].

Key principles of successful landscape-scale management for wildlife:

- Maintenance of the structural and functional integrity of ecosystems so that they continue to work effectively.
- Recognition that change is inevitable due to natural succession, human intervention and external factors such as floods, pollution and climate change. Management must be forward-looking and flexible enough to respond to these changes.
- Recognition of the need for multi-sector collaboration, as no single group, agency or sector has a complete understanding of, or full jurisdiction over, ecosystems. Much more can be achieved in partnership.
- Analysis of activities affecting ecosystems, including the values, perspectives and socio-economic needs of key stakeholders in all sectors.
- Integration of social and economic objectives with environmental objectives in order to develop options for sustainable use of natural resources. Integrated solutions are more likely to deliver multiple, long-term benefits.
- Ecosystems must be managed within their environmental limits.
- Monitoring of key components of the ecosystem to assess their response to management. Changes in the natural elements of ecosystems can be sensitive indicators of damage. Monitoring of species known to be particularly sensitive to change can be particularly useful.
- Modifying management practices or objectives if monitoring indicates that ecosystems cannot meet the demands placed upon them.
- Basing ecosystem management on existing knowledge and understanding. Where understanding is limited, we must use the precautionary principle.



Landscape-scale management retains terrestrial and aquatic features.
Stephen Davis/English Nature

4.3 Developing a vision

To take forward landscape-scale management for wildlife, a shared vision with stakeholders representing a wide range of interests needs to be developed. This should involve those who use and manage the land, and those who live in and visit it. The vision needs to be inclusive, relevant to all sectors of society, and must consider the interests of current and future generations. It needs to build understanding and co-operation between all those involved, to harness their enthusiasm and commitment, and reach agreement on actions that will shape the wildlife landscapes of the future. The aim is to find ways to accommodate a mosaic of rich wildlife habitats, supported by and integrated with environmentally sustainable economies and communities, throughout lowland England.

We must, however, look to the future not to the past. Whilst the twentieth century saw huge impacts on biodiversity as a result of economic development, it is equally clear that in our modern society we should not seek a strategy that tries to re-create an England of the past. What is needed instead is a new vision of lowland landscapes, which recognises the legitimate needs of our modern society, but which equally respects environmental capacity, and develops innovative approaches that will deliver biodiversity and geological gains.

4.4 Delivering future landscapes for wildlife

Practical examples are needed to demonstrate how our nature conservation objectives can benefit economic and social agendas. In this section we provide examples to show how landscape-scale management might work in practice.

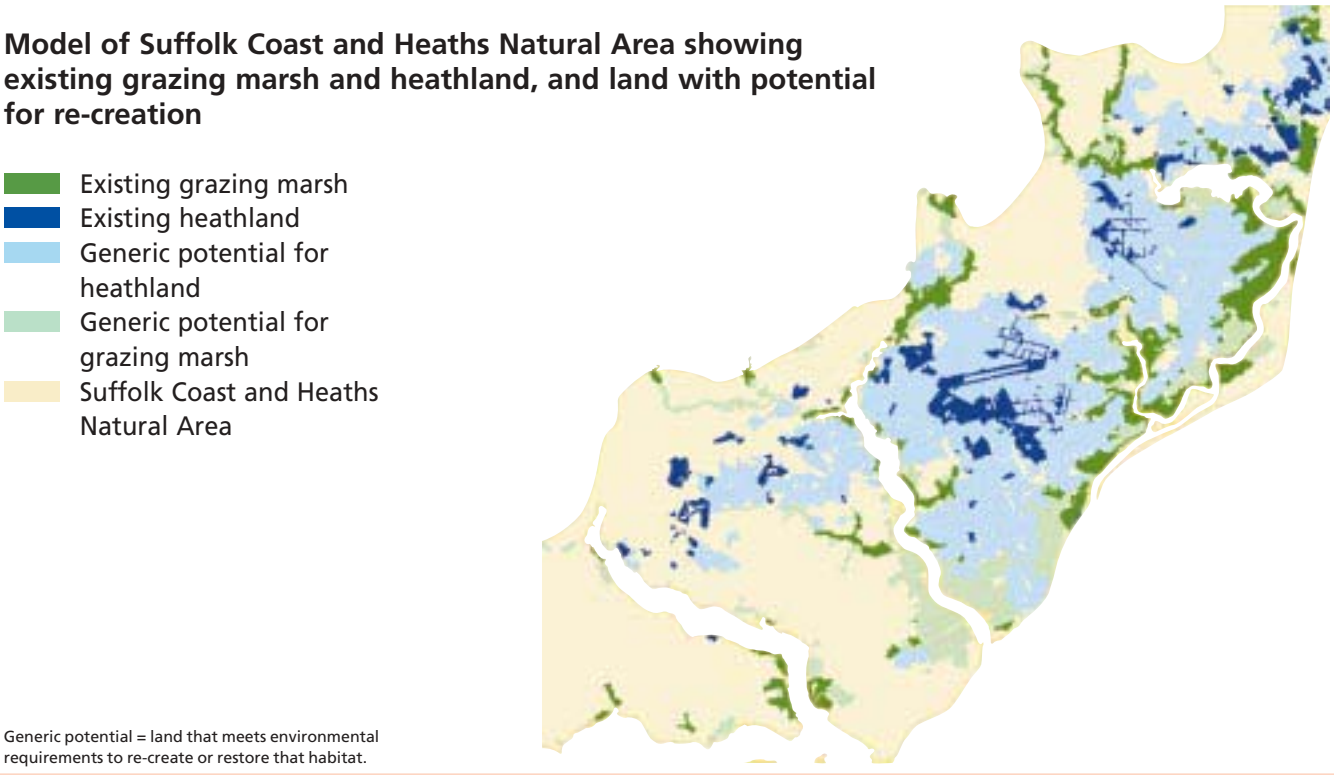
One of the first steps in managing landscapes for wildlife is to understand their existing conservation importance and environmental capacity. For informed decision-making, habitat and species data should be analysed and evaluated to assess the options for creating and restoring habitats. Local Record Centres, such as the Suffolk Biological Records Centre, play a key role in providing information on the current and past state of wildlife.

Mapping biodiversity in Suffolk

A Suffolk partnership is mapping the wildlife of the county, and the Suffolk Biological Records Centre has produced a model to help evaluate future conservation options, and how these can be integrated with a range of cultural and economic factors to help inform decisions about future land use.

This model, based upon a geographical information system, provides options for where best to target action on the ground. The model is flexible, and can be updated with new information that may result from changes in policy or local opportunities.

Model of Suffolk Coast and Heaths Natural Area showing existing grazing marsh and heathland, and land with potential for re-creation



Generic potential = land that meets environmental requirements to re-create or restore that habitat.

The uncommon hairy dragonfly will benefit from the Chichester Plain Initiative.
Allan Drewitt/English Nature

Because of its complexity, working at the landscape scale requires working with a wide range of partners, including those who do not have an environmental remit. This often means that biodiversity may not be the primary purpose of landscape-scale projects, and wildlife benefits are achieved alongside the delivery of other objectives, such as flood defence, tourism or health. Increasingly, partners are recognising that landscape-scale projects can indeed bring social and economic benefits. For example, a project on the Chichester Plain in Sussex, originally aimed at increasing the biodiversity value of the area, has improved the economic returns of 70% of the farmers within the project area.

Sustainable Farmland and Biodiversity Initiative

The Sustainable Farmland and Biodiversity Initiative for the 10,000 ha Chichester Plain was set up in 2000, as a partnership between Oxford University's Wildlife Conservation Research Unit, the Farming and Wildlife Advisory Group, Sussex Wildlife Trust, Chichester Harbour Conservancy, the Environment Agency, English Nature, West Sussex County Council and 42 local farmers.

The project surveyed 6,100 ha of farmed land, 74 km of waterway and 148 km of ditches, and the results were used to prepare restoration options. The project has helped farmers to obtain Countryside Stewardship Scheme grants, through the production of individually tailored whole farm plans and nutrient budgets. Innovative work with the Environment Agency has resulted in riparian habitat management regimes that are tailored to differing flood risks. This has greatly improved the quality of the riparian habitats for water vole, and also benefited scarce dragonflies and farmland birds, brown hare, and rare arable weeds.

As we have stated, some declining species, such as the great crested newt and marsh fritillary butterfly, depend upon a number of adjacent sites, within a landscape. Such species cannot be effectively conserved through single site protection. A landscape-scale management approach would also benefit species occurring in the wider countryside, such as the rare greater horseshoe bat.

Greater horseshoe bat

Bats are a good example of species that respond to conservation action at a landscape scale. The greater horseshoe bat prefers a landscape of grazed grassland, hedges, scrub and woodland, and feeds on large insects associated with these habitats. It is one of Europe's rarest bats, and south west England and south Wales are its British stronghold. The populations in Devon are increasing dramatically, due in part to a project that aims to secure sympathetic land management for the bats by promoting Countryside Stewardship agreements to landowners within 4 km of key bat roosts[153]. The project has been a great success:

- Since 1998 the project has secured over 600 ha of insect-rich grassland foraging areas, over 60 km of new field margins, and 100 km of renovated or replanted hedgerows.
- The Devon greater horseshoe bat population has increased by 58% since 1995, and the UK BAP target to increase the number of bats by 25% by 2010 is likely to be met.
- Sympathetic management of the landscape for bats brings wider benefits, particularly for invertebrates such as moths, including the large yellow underwing, and dung beetles.
- Landowners involved in the project have taken a real interest in wildlife, and volunteers have helped monitor the bats.
- The project has strongly influenced the targeting of Countryside Stewardship in the South West Region, and should have spin-off benefits in other areas of the country.

Greater horseshoe bat landscape near Buckfastleigh, Devon.
English Nature

Using the examples of existing projects, and the experience gained from these and other initiatives, English Nature intends to play a stronger role in landscape-scale nature conservation. We will invest substantial funds, in active partnership with others, to further this approach. These landscape-scale projects will contribute significantly to the England Biodiversity Strategy, the Rural White Paper[154] and sustainable development initiatives.

Landscape-scale management for wildlife projects

There are a number of projects demonstrating gains for wildlife by working at the landscape scale. These include schemes that use targeted agri-environment mechanisms and other funding sources:

- A Countryside Stewardship Scheme special project targets cirl buntings in south Devon.
- Provision for bumblebees in field margins using Countryside Stewardship.
- Tomorrow's Heathland Heritage includes many projects across England, such as 'Restoring the sea of heather – Cornwall', which will produce economic, social and nature conservation benefits.
- Work in Berkshire, Hampshire, West Sussex to restore former habitats and create new ones for sand lizards.
- The Parrett Catchment Project in Somerset, part funded by European Intereg 3b, is investigating catchment-scale approaches to flooding such as temporary flood storage on farmland, and the establishment of woodland.
- Based on the Humberhead Peatlands NNR and Humberhead Levels Natural Area, the 'Value in Wetness' initiative covers several interrelated projects addressing landscape-scale work and community involvement in heritage and access.
- The Sherwood Forest Initiative is seeking to restore ancient woodland and improve post-industrial landscapes by involving local communities.
- The National Trust's reserve at Wicken Fen is surrounded by arable farmland. The habitats on the Fen provide the core from which it is planned to greatly increase the area of wetland within the next 100 years. Several other examples are also in hand, such as the Great Fen project linking Woodwalton Fen and Holme Fen, and Lakenheath Fen.

5 People, polices and partnership

In this chapter we examine the benefits that people derive from nature and natural processes, and demonstrate how nature conservation at the landscape scale can only be delivered by involving people more actively, through integrating policies more effectively, and through successful partnership at regional and local levels.

People value green space, which can improve their health. Berwick Hills LNR.
Paul Glendell/English Nature

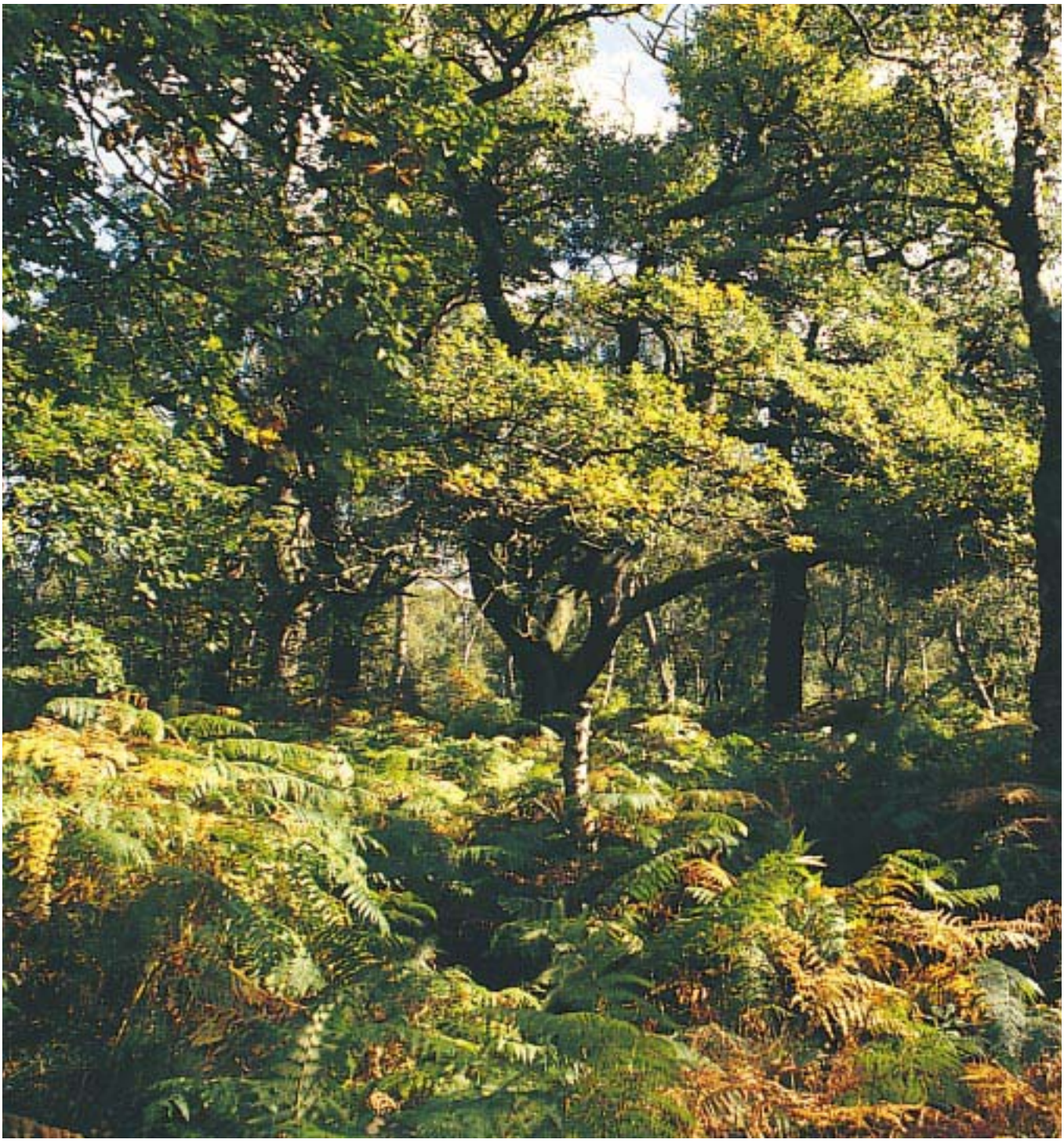
5.1 Re-connecting people with nature

The value of nature

In order to foster public support for nature conservation and engage all members of society in developing a vision, people need to understand and value the essential contribution that nature makes to the quality of their daily life. The connections between a healthy environment and people's economic well-being, environmental rights and options, social equity, quality of life, and health, need to be made clearer[155].

Green spaces encourage people to enjoy regular exercise.
Paul Glendell/English Nature 24,330

The value of green spaces in encouraging people to take regular exercise is demonstrated by the BTCV's 'Green Gym', and the Countryside Agency's 'Walking Fit For Life'. These can contribute to the Government's 'Healthier Nation' targets for reducing heart attacks and obesity. Trees have been shown to reduce stress, skin cancer and air pollution[156], and further evidence shows that contact with nature is good for the mind[157], as quiet enjoyment of natural surroundings can help relieve depression, anxiety and mental distress[158]. Countryside management work can improve personal skills and confidence, and at the same time makes a valuable contribution to conservation[159]. Local greenspaces serve as a focus for social interaction and community action, for example, in the regeneration of derelict neighbourhoods, and rehabilitation of offenders and former drug users[160, 161].



Woodlands contribute to storing atmospheric carbon.
Peter Wakely/English Nature 18,531

Furthermore, the benefits of living and working in a rural or green landscape have been recognised for a number of years, as demonstrated by advertisements to lure businesses to new locations, by job vacancy details that describe the attractions of the surrounding countryside, by the concept of the garden city, and by the higher house prices in rural locations compared to urban equivalents.

Nature provides the essential services that regulate our climate. For example, peat bogs and woodlands store carbon, and the importance of this is increasingly being understood in relation to pollution and climate change. Natural systems also play a very important role in pollution control and detoxification, by removing nutrients and pollutants from water, filtering dust from the air, and reducing noise and wind. Natural processes and resources create the soil, decompose waste, pollinate our crops and gardens, and provide natural pest control, whilst floodplain wetlands can buffer water flows, providing flood and storm protection.

Medicinal, cosmetic and ornamental products can be obtained from nature, although they must be harvested in a sustainable way. By harnessing natural systems, rural industries can contribute to the local economy by providing renewable energy. The Government is committed to 10% of electricity demand being met by renewable energy resources by 2010, and 20% by 2020. Yet, for example, less than 0.5% of the East of England's electricity demand is currently met this way. Energy crops would contribute towards this target, but wood-fuel (firewood and charcoal) has more potential as a renewable source of heat energy. The planting of new woodland could help meet this target[162].

But nature does more than this. It provides spiritual and artistic inspiration, and contributes to an understanding of history and sense of place. It helps satisfy a quest for knowledge, and is an important part of English cultural and spiritual identity.

Traditional woodland use:
Above - charcoal production. Peter Wakely/English Nature 20,305
Left - Hurdle making. Paul Glendell/English Nature 24,875

Public responses

The Government recognises the important link between wildlife and the quality of life: effective protection of the environment, and prudent use of natural resources, are two of the four objectives of sustainable development[163]. Government has established, within the framework of the UK Sustainable Development strategy, a suite of Quality of Life Indicators against which they are measuring achievement and progress. Several of the headline indicators reflect environmental needs.

Quality of Life Indicators

Headline indicators to ensure effective protection of the environment have the following objectives:

- Continue to reduce our emissions of greenhouse gases now, and plan for greater reductions in the longer term.
- Reduce air pollution and ensure air quality continues to improve through the longer term.
- Improve choice in transport, improve access to education, jobs, leisure and services, and reduce the need to travel.
- Improve river quality.
- Reverse the long-term decline in populations of farmland and woodland birds.
- Re-use previously developed land, in order to protect the countryside and encourage urban regeneration.

A key element of the remaining two objectives of sustainable development is social equity. In the context of this report, this means that everyone is entitled to experience the benefits of contact with nature. People should have easy access to nature, in ways that suit their individual situation and abilities, both close to home and in the wilder places across England.

Visitors are welcomed to National Nature Reserves. Martin Down NNR. Stephen Davis/English Nature

Community-based wildlife gardening project supported by Prince's Trust and BTCV.
Rod Leach/BTCV

It is evident that many people do derive satisfaction from nature and attach great value to it. This is shown by the number of visits to the countryside. For example, more than 1.2 billion day visits were made to the countryside in 1998, and it has been estimated that National Nature Reserves receive over 13 million visits each year[164]. Other evidence includes the strength of the voluntary nature conservation movement, the popularity of gardening and outdoor walking (often the foundation for developing an interest in nature), and the growing numbers of local voluntary and community-based nature conservation and wildlife gardening projects.

However, the task of raising public awareness of environmental issues is large. In a recent survey of public attitudes to quality of life and the environment, only 1 in 4 respondents were aware of the term biodiversity[165]. In the same survey, opinion was fairly evenly divided as to whether or not there is significant connection between the protection of the environment and people's quality of life.

The England Biodiversity Strategy makes a specific commitment to involve children and young people in the development of policy on biodiversity. A Strategy Implementation Group has been established to involve the education sector and raise public understanding. Involving people in all levels of decision-making and debate will help to foster a shared ownership of a healthy, nature-rich environment. The links between healthy biodiversity, regional economic growth, and social benefits that contribute to sustainable development, must be clearly demonstrated so that people will understand that integration provides benefits for all.

In the following sections, we consider the different ways that people can be involved at a variety of levels – as an individual, in communities, and at the business level.

Volunteers involved in NNR management.
Peter Roworth/English Nature

Individuals

Public concern for wildlife and support for initiatives to benefit the countryside are increasing. Everyday lifestyle choices give rise directly and indirectly to the majority of the impacts on the environment but, with greater knowledge and awareness, people can understand and modify their decisions. These personal choices relate to what we buy, how we travel, and our attitude towards the use of natural resources. When making these choices we can consider, for example, the source and impact of production methods of the food and other commodities we purchase, and we can consider the environmental impacts of different modes of transport. Other personal actions include working with others through volunteering, education and contributing to planning decisions that affect our local environment. Gardening for wildlife will also benefit the environment.

Communities

Local communities provide a valuable opportunity to integrate the ecological, social and economic agendas through partnership working. There are many examples across the country where local communities already carry out environmental projects that improve neighbourhoods for adults, children and nature. Some of these projects involve local communities managing wildlife in their areas, such as the Mineral Valleys Project in West Durham.

Mineral Valleys Project, West Durham

The Mineral Valleys Project is a bold and imaginative partnership programme, funded by the Heritage Lottery Fund and a wide range of other bodies, which brings together the communities of West Durham to enhance and interpret their natural and cultural heritage. This heritage is founded on the long history of extraction of the rich mineral resources of the area, especially lead, coal, iron, fluorspar, limestone, sand and gravel.

Volunteers building otter holt, West Durham Mineral Valleys Project. David Long, DWT

The five-year project is driven by a common vision to transform the local natural, cultural and historical landscape into environmental assets valued by and interpreted for all. Derelict areas will be restored through habitat enhancement, including the creation of major new wetlands. Nearly 350 ha of woodland will be regenerated, and land will be purchased to create new, accessible community woodlands. Volunteers will help to improve the area for otter, water vole, juniper and barn owl, and monitor progress towards local BAP targets.

In Cambridge, habitat corridors are being developed to connect greenspace in the city with adjacent countryside, and to improve access in and out of the city along footpaths and cycle greenways. Other projects involve balancing the pressures and needs of tourists visiting local wildlife sites with the needs of local communities, such as the Sand Pit Project near Leighton Buzzard in Bedfordshire. Here, high-quality open space, created in restored sand pits, reduces recreational pressure on other fragile wildlife sites. Other practical involvement in projects of benefit to local wildlife and local communities include willow pollarding, construction of otter holts, and serving as volunteer wardens. Elsewhere, people are also learning more about their local area through becoming involved in habitat mapping, species surveys, and recording oral and photographic history.

Local authorities have powers to promote or improve the social, economic and environmental well-being of their area[166], for example through a Community Strategy. These strategies are intended to contribute to the achievement of sustainable development in the UK. The Local and Regional Implementation Group of the England Biodiversity Strategy is helping to build biodiversity into local and regional governance, through developing guidelines and collating examples of good practice, including guidance on how biodiversity can be incorporated into Community Strategies. Local people can use Community Strategies to protect and enhance their local environment. In some areas, Parish Environmental Action Plans provide a mechanism for local communities to identify local wildlife resources, and define more local priorities.

Abandoned quarries can provide a rich wildlife resource for local communities: Bishop Middleham Quarry SSSI, Co. Durham. David Townshend/English Nature

Business

People can also engage with wildlife through work with businesses. Water companies, food retailers and processors, and construction companies have a significant influence over water and wetlands, agricultural and urban habitats. They have a major role and can be instrumental in taking opportunities for habitat enhancement and creation, even on areas that currently have little wildlife. English Nature is encouraging companies who own SSSIs to manage and report on the condition of their sites in corporate environmental or social responsibility reports. Hanson Building Materials Europe and Thames Water, for example, currently publish data on their SSSIs.

Businesses have an essential part to play in protecting lowland habitats. They often find themselves at the forefront of conflict over controversial developments, but can help to resolve some of these conflicts through early co-operation and dialogue with nature conservation organisations. This can help locate developments away from designated sites, avoid or minimise damage to wildlife, and mitigate or compensate for any unavoidable loss. A good example of this is provided by the Building for Nature project.

Mixed-use development at Ropetackle, Shoreham. Helen Doran/English Nature

Building for Nature

Increased development pressures are affecting the whole of south east England. The Building for Nature project, supported by the South East England Development Agency, English Nature, the Environment Agency, and other key organisations from the construction and conservation sectors, aims to minimise the impact of building development on the environment, and seek positive gains for wildlife in new developments.

The project has had a big influence at the Ropetackle site in Shoreham, West Sussex, a mixed-use development adjacent to the Adur Estuary SSSI. The project is working with architects and Berkeley Homes to design swift and house martin boxes, bat roosts and vegetated shingle areas into the development. These will enhance the site, and contribute to the Sussex Biodiversity Action Plan.

In addition, companies such as Co-op Bank, Tesco, ICI and Anglian Water have acted as champions for BAP species, and many companies who own land, such as Northumbrian Water, Centre Parcs and Network Rail, have their own corporate Biodiversity Action Plans.

Network Rail has an action plan for biodiversity along the rail system. Paul Glendell/English Nature 24,814

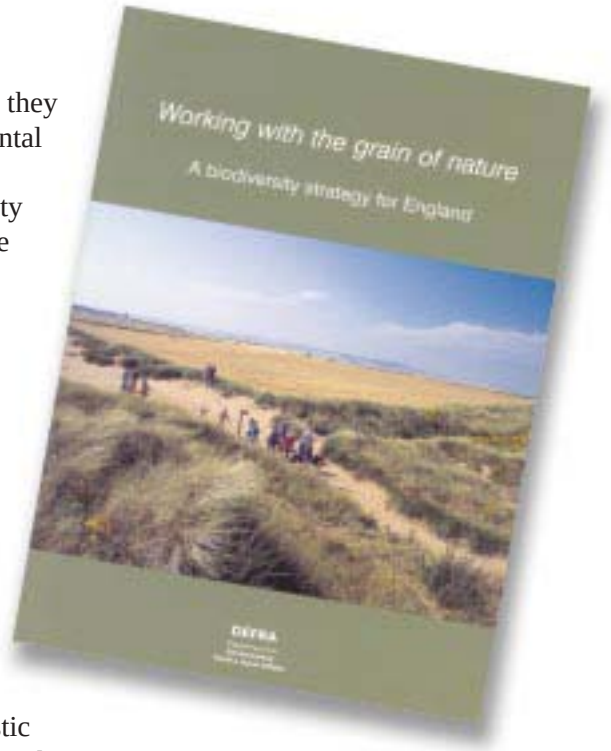
Network Rail's Corporate Biodiversity Action Plan

Transport infrastructure covers 3-4% of the land area of England, and the existing trunk road and rail networks pass through areas of high wildlife and biodiversity value. Transport routes can act as important wildlife corridors for some species, and make a worthwhile contribution to the delivery of Biodiversity Action Plan targets.

Network Rail directly manages parts of 111 SSSIs, and has developed an Action Plan to provide information about special habitats and species occurring on or near to railway land. It also provides information on working practices and contacts, to ensure that staff can manage these wildlife-rich areas appropriately.

Businesses can also contribute to raising levels of understanding about environmental issues amongst the general public. Some have recognised the power of ethical buying, and use green credentials in advertising. For example, attention is now being given to appropriate marketing and labelling in order to improve sales of home-produced woodland products, and other products sourced from wildlife-friendly systems. The England Biodiversity Strategy recognises the important role businesses can play in conserving biodiversity, and a Strategy Implementation Group has been established to engage with the business community.

5.2 Policy integration issues



Policy frameworks also need to become more integrated so that they promote the sustainable use of land, water and other environmental resources. This will ensure they accommodate social and economic needs, whilst also ensuring the recovery of biodiversity and ecosystem health. Better policy design is essential if we are to meet the Government's four objectives for sustainable development.

The need for environmental policy integration is recognised at many levels. The first report of the Select Committee on Environmental Audit[167] stated that "EU policies (in the areas of agriculture, transport and energy) have often been incompatible with, or even contradictory to the EU's environmental objectives" … and that there is "a need for joint action across all sectors, both preventative and regulatory". It also noted that, "integration of environmental policy into those sectors in which pressure is put on the environment is vital to address the root causes of environmental damage".
The England Biodiversity Strategy reflects this need for an holistic approach and in 2003 the Government established a High Level Delivery Group to engage all relevant Government departments and agencies in helping to achieve the Strategy's objectives.

Efforts to promote sustainability are currently hampered by the lack of integration between the various policy regimes that determine and regulate the use and management of land, water and other natural resources. Better policy integration, and the adoption of an ecosystem management approach, could reduce the economic and social demands on natural resources. Growth in demand in all sectors must be managed if we are to achieve sustainable development. It is particularly important to increase resource productivity, in other words 'do more with less'. Adopting resource-efficient technology to make best use of raw materials, and reducing loss to waste treatment or disposal, must become the norm. For example, developers could be required to achieve 'no net demand' for water, using such methods as porous surfaces, recycling of water, and incorporation of wetlands.

So far, there are few instances where local authorities, local businesses, Government departments, environmental agencies and pressure groups have grouped together to tackle and manage economy and environment issues at the sub-national scale[168]. There is a need for a large range of organisations and individuals to work in partnership and co-operation to achieve sustainable development. Local authorities are key drivers and agents of delivery of environmental and economic development policies. There are also other key players who have an important contributory role.

Below, we give examples of how an integrated policy approach can address complex issues in the development sector, in managing a natural resource, and at the regional level.

Policy integration between sectors - location of housing developments

A housing development will have a range of potential impacts on the environment, not only on-site but also away from the development area. The spatial planning process, determined by local planning authorities, reviews existing and possible alternative land uses, and a range of nature conservation, heritage and landscape considerations. The location of existing industry and other sources of employment, existing and new infrastructure such as schools and commercial businesses, and the capacity of existing transport corridors and facilities, are also considered. However, a weakness of the current spatial planning process is that these on-site issues are not examined in the wider context. Important aspects that occur outside the proposed development site include the sources and supply chain of the raw materials, the supply of water resources and energy utilities, transport links and associated demands for new infrastructure.

In addition, the catchment planning process should assess the potential impacts of new development on the flood storage capacity of relevant river and coastal floodplains, flood risk management and land drainage. The control of pollution through environmental regulation also needs to take account of waste discharges, the disposal of waste arising from the development, and emissions to the atmosphere.

As a consequence, decisions on a new development are made through a variety of processes involving a range of agencies. These bodies may have different legislation, timescales and standards for considering environmental impacts and benefits. Integration between these bodies is essential if environmental protection is to be effective, and sustainable development is to be achieved.

Housing development can have significant environmental impacts.
Paul Lacey/English Nature

Undeveloped floodplains can store flood waters.
Somerset Levels.
Paul Glendell/English Nature 25,142

Policy integration for resource management - water and wetlands

Rivers and wetlands are valuable not only for the wildlife they support, but also for the ecosystem functions and services they can provide. For example, wetlands can help clean the water we drink, recycle waste, protect us from flooding and provide opportunities for tourism and recreation which contribute to the local economy. Because of these wider social functions, wetlands demonstrate the potential for integrating biodiversity objectives with other socio-economic policies.

Water and wetland sites are particularly vulnerable to a range of external impacts such as over-abstraction, nutrient enrichment from point source and diffuse pollution, and continuing acidification from the atmosphere. An integrated approach to agricultural policies and practices, flood management, water resources, water abstraction and waste discharges at a catchment-scale could deliver multiple benefits to ensure the long-term sustainability of our water environment.

River Basin Management Plans, due to be launched in 2009 under the Water Framework Directive, could provide an integrated approach to catchment planning. To ensure effective implementation of this Directive, complementary measures at a catchment level are needed, linking the Management Plans to land-use planning, water quality, water abstraction, flood management, fisheries, nature conservation, and amenity.

5.3 Regional opportunities to deliver wildlife at the landscape scale

The regional agenda

Sustainable outcomes need policy integration for resource management, within and between sectors. Regions provide an excellent opportunity to translate this into delivery at the landscape scale.

The regional agenda has been evolving rapidly since 1998, with the creation of Government Offices for the Regions, Regional Development Agencies, Sustainable Development Round Tables, various forms of environmental stakeholder groups, and Regional Assemblies. In every region a host of regional plans and strategies are being developed, including Regional Planning Guidance, Regional Transport Plans, Regional Economic Strategies, Sustainable Development Frameworks, Rural Development Plans, and regional biodiversity audits and strategies. Research is being sponsored, in partnership with other regional environmental bodies and development agencies, linking the environment and regional economies, and work is being published on the social benefits of the natural environment[169].

The environmental dimension of regional policy has become increasingly important. This trend is set to continue, with Government proposals for elected Regional Assemblies to have responsibility for preparing Regional Biodiversity Strategies, statutory Regional Spatial Strategies, and Regional Transport Strategies. Furthermore, European Union and UK Government expenditure is increasingly being channelled through Regional Development Agencies and Government Offices. A recent White Paper on regional governance provides scope for joined-up environmental services[170].

Traditional breeds such as Ruby Red (North Devon) cattle contribute both to regional character and wildlife management.
Rob Wolton/English Nature

Local farmers' markets reduce transport costs.
Paul Glendell/English Nature

Sustainable development

Sustainable development is a key underpinning principle for regional working, and fundamental to the delivery of the England Biodiversity Strategy[171]. It is also essential if the key issues in chapter 3 are to be addressed. The Strategy aims for:

"full integration of biodiversity considerations within plans and policies for the English Regions and in particular as part of the updating and implementation of Regional Sustainable Development Frameworks and the activities of Government Offices, Regional Development Agencies, Regional Chambers/Assemblies, and Government agencies operating at the regional level".

Sustainable development will only be achieved if environmental considerations are genuinely integrated within regional strategies and programmes, and the resulting plans and activities of regional bodies. It is important that the linkages between biodiversity recovery, economic growth and social benefits are recognised and valued by regional decision-makers, in order that their decisions can contribute to SSSI and wider countryside objectives, and UK BAP targets.

Environmental considerations need to be at the heart of regional objectives, targets and indicators, and given appropriate weight in regional scrutiny processes and sustainability appraisals. As much of the machinery of regional governance is still being developed, there are currently good opportunities for environmental policy integration in regional policies and plans. However, with so much change taking place and the pre-eminence of economic development and social regeneration as regional drivers, it is important that the environment is not seen as a barrier, but rather as providing opportunities for economic development and social progress.

The key regional bodies need objective and well-informed advice, expertise in environmental matters, and an ability to relate these to sustainable development within the social and economic agendas. They also need support in developing projects, strategies, policies and indicators, and information about the natural environment. This support and advice will underpin the policy evidence-base, and serve as a baseline for use in regional scrutiny and monitoring processes.

Regional delivery

Much landscape-scale working is already being achieved at regional level, positively contributing to economic growth and social benefit (see Annex 2).

Regional spatial planning

The advent of statutory Regional Spatial Strategies has increased the significance of regional spatial planning. Regional Planning Guidance is being revised, and will help to inform and influence the treatment of the natural environment. Reviews of Regional Planning Guidance and Regional Spatial Strategies, with related work on indicators and monitoring, continue to provide opportunities for joint working with Regional Assemblies, and to be a major area of activity for regional policy influence.

Other examples of Regional activity include guidance offered to nature conservation organisations on how to engage with the Community Strategy process and integrate biodiversity into these Strategies, and the development of Regional Forestry Frameworks. These Frameworks can consider economic factors (for example, non-market products and services, regeneration of jobs and businesses) and the identification of social and quality of life benefits, as well as the environmental and biodiversity aspects of forestry.

Environmental monitoring

Many regions have adopted biodiversity indicators and biodiversity policies in their regional spatial planning. The indicators include SSSI condition, populations of wild birds, delivery of regional and local BAP targets, ecological frameworks and natural greenspace, and are being used to monitor the sustainability of strategic plans.

The National Biodiversity Network and network of Local Record Centres could provide information on the natural environment in easily accessible formats at a range of geographical scales. In order to assist Regions, English Nature published a series of reports describing the broad nature conservation and Biodiversity Action Plan (BAP) priorities, biodiversity indicators and targets in each region based on 'Natural Areas'[172].

Most regions have produced some kind of regional climate change study. Work is currently being developed to provide regional climate change advice based on the national MONARCH climate change project.

The stone-curlew is a biodiversity indicator in the East of England region.
Paul Glendell/English Nature 25,003

6 Conclusion

In our report, we have shown that lowland England has suffered significant habitat losses in the twentieth century. This decline in the extent of semi-natural habitats, due in particular to agricultural intensification, has largely ceased within the last 20 years, although losses due to development still continue. The remaining habitats are typically very fragmented, and isolated within intensively managed landscapes.

Many of the surviving areas are in poor condition due to a range of pressures, notably agricultural intensification, lack of appropriate management, water quantity and quality problems, atmospheric pollution, climate change, and the effects of invasive species. Many formerly widespread species are no longer a common sight in the lowlands. Furthermore, the natural processes that we all depend on are being disrupted.

In spite of positive action, such as stronger legislation, the UK BAP process and more focused use of agri-environment schemes, it is clear that a site-based approach alone will not meet England's national and international obligations for the conservation of habitats and species, or many of the targets set under the UK BAP and the Public Service Agreements. The condition and resilience of protected sites must still be maintained or improved, since they act as wildlife refuges for threatened species, and are the core areas for the subsequent recovery and re-colonisation of land between special sites. However, this must be done in the context of the surrounding countryside. Nature conservation must now be achieved through a new landscape-scale approach to nature conservation. Management of the whole landscape or water catchment is essential to maximise the social and economic benefits that can be obtained through sustainable land use.

Wildlife-rich landscape, River Wye.
Peter Wakely/English Nature

To take forward landscape-scale management for wildlife, groups and individuals representing a wide range of interests need to develop a shared vision. This should involve those who use and manage the land, and those who live in and visit it. The vision needs to be inclusive, relevant to all sectors of society, and must consider the interests of both current and future generations. It needs to build understanding and co-operation between all those involved, to harness their enthusiasm and commitment, and reach agreement on actions that will shape the wildlife landscapes of the future.

The new vision of lowland landscapes must recognise the legitimate needs of our modern society but, at the same time, respect environmental capacity. It should stimulate innovative approaches to deliver biodiversity and geological conservation gains.

The benefits that people derive from nature and natural processes are many and varied. However, in order to foster public support for nature conservation and engage all members of society in developing a vision, people need to understand and value the essential contribution that nature makes to the quality of their daily life. The connections between a healthy environment and people's economic well-being, environmental rights and options, social equity, quality of life, and health, need to be made clearer.

As well as engaging people at different levels (from Government to individual) to deliver an integrated, landscape-scale approach, policy frameworks must give greater importance to the protection of environmental assets, recognising that some are irreplaceable and sensitive to cumulative effects. Policies must also be more integrated, so that they promote the sustainable use of land, water and other environmental resources. We need a more environmentally sensitive approach to urban regeneration and planning which puts biodiverse greenspace at its heart, and recognises its importance to people as well as the environment. Better design of policies is essential if we are to meet the four objectives of sustainable development.

Better policy integration, and the adoption of an ecosystem approach to management of land and water, could reduce the economic and social demands on natural resources. Growth in demand in all sectors needs to be managed. All the relevant organisations, agencies and sectors of society must work closely together, using ecosystem management principles to find integrated solutions to environmental problems that deliver conservation, social and economic goals.

We look to a future countryside richer in plants such as field cow-wheat.
Peter Wakely/English Nature 17,929

Regions provide an excellent opportunity to translate this into delivery at the landscape scale and much is already being achieved at regional level, contributing to economic growth and social benefit. Examples of effective and successful actions by regional partnerships can be found in every Region, covering such issues as sustainable tourism, spatial planning, environmental monitoring, renewable energy, sustainable agriculture, and wetland creation and management.

We all need to protect our natural heritage, for its own sake, for ourselves and for future generations. We have a responsibility to the next generation to hand over a world no less rich than the one that we inherited, and to respect the environment on which we depend.
We must ensure that the resilience of the ecosystem is no longer compromised and its recovery is nurtured. Habitats and species have taken a long time to evolve, but can be lost quickly, sometimes before their potential value is realised. We all need to ensure that land use and policy decisions do not compromise future access to nature, or a healthy and resilient environment.

Annex 1

Summary of pressures and actions under way in the water environment

Type of pressure	Actions taken	Comments
Drainage	Water level management plans on 500 SSSIs affected by drainage.	Government initiative since 1994, but only 31% implemented.
	Government grants for field drains withdrawn in 1990.	
	Blocking of drains and grips.	Only a few local projects, mainly on nature reserves.
Flood defence	Reduction of grant-aid for agricultural schemes since 1990.	Most agricultural areas already protected.
	BAP targets for re-creation of reedbeds, fens and grazing marshes since 1996.	Good progress on reedbeds, but fens and grazing marshes require significant areas of land. English Nature's Great Fen project received a Treasury grant in 2002.
	Defra, Environment Agency, Forestry Commission and English Nature statement on wetlands, land use and flood management (2003).	Local initiatives to reconnect rivers and floodplains, eg Severn and Avon Vales project. Defra is willing to support a catchment-scale demonstration project.
	Proposal to introduce Catchment Flood Management Planning.	Pilots have been delayed, meanwhile the biggest ever five-year programme of conventional defences is under way increasing from the current £414m to £564m in 2004-06.
Peat extraction	Government funded English Nature in 2001 to buy out major extant planning permissions.	English Nature working with Scotts to create conditions suitable for re-wetting drained peatlands (eg Humberhead Levels).
	Campaign to use alternatives to peat in horticulture.	Garden centres now stock alternatives, but peat still being imported in large quantities.
Physical modification	River Habitat Survey undertaken by the Environment Agency since 1996 has identified the scale of the problem.	Environment Agency intends to set habitat targets for rivers by 2004, but it has no powers or budget for undertaking the necessary restoration work.
	Fish passes inserted in major barriers to salmon migration.	Weirs and other - often redundant - structures still interfere with river processes.
	Demonstration schemes to raise river beds and re-create meanders funded by European Commission in 1994. River Restoration Centre founded in 1996.	Some imaginative schemes linked to flood defence solutions, eg Jubilee River. Small-scale restorations funded by English Nature and fisheries trusts. Technique of geomorphological audit developed to help target restoration.

continued »

Type of pressure	Actions taken	Comments
Physical modification (continued)	EC Water Framework Directive includes hydro-geomorphology as an element of ecological status for rivers and lakes.	A national programme of restoration may be required from 2009.
Inappropriate management	*Nature conservation and the management of drainage channels* handbook produced by English Nature and the Association of Drainage Authorities in 1989.	Improvement in design and management of a number of Internal Drainage Board channels.
	Powers for English Nature to enforce its advice on positive management in CRoW Act 2000.	Landowners' actions: management of bankside vegetation, exclusion of stock to prevent collapse of banks. Limited to SSSIs.
	Duties on public bodies to further the conservation and enhancement of SSSIs (S28G CRoW Act 2000).	IDBs, Environment Agency, British Waterways, water companies and local authorities: dredging, weed cutting and other management operations. Agreements need to be drawn up by English Nature on relevant SSSIs.
	Prescription for ditch management in new entry-level agri-environment package.	May not be financially attractive to farmers who are causing most damage.
Pollution	Agreement between English Nature and the Environment Agency in 2003 on phosphorus targets for river and lake SACs, and also applied to SSSIs for AMP4.	Stimulated by joint working on review of consents under the 1994 Habitats Regulations.
	Water company investment in phosphorus removal at sewage treatment works affecting SSSIs.	Started in Norfolk Broads and Lake District in mid-1980s. Should embrace all relevant SSSIs by end of AMP4 (2010). Needs to be extended to effluent discharges from industry.
	EC Water Framework Directive will require controls on diffuse pollution from agriculture and other sources affecting status of rivers, lakes and groundwaters by 2012.	Early action is needed to protect SSSIs and Natura 2000 sites affected by silt and nutrient pollution in order to meet PSA target for SSSIs (2010) and reporting to European Commission on 'favourable conservation status' (2006).
	English Nature and the Environment Agency have proposed a package of measures aimed at farmers for introduction in 2004 as part of Defra's Diffuse Water Pollution from Agriculture project (2003).	Voluntary participation may not capture main offenders. Statutory back-up is needed.
	English Nature initiated research into modelling technique (PSYCHIC) for diffuse pollution.	Defra and the Environment Agency are partners in this work which is due for completion in 2003. Testing is needed in 2004.
	A few local schemes to help farmers with best management practices, eg Landcare run by the Environment Agency in the upper Avon catchment.	Changes in land use will be needed in some catchments (including the Salisbury Avon) to prevent silt entering rivers during heavy rainfall.
		continued »

Type of pressure	Actions taken	Comments
Pollution (continued)	Mud-pumping of lakes to remove accumulated silt, by the Environment Agency, Broads Authority and English Nature.	Limited to a few sites in the Broads. English Nature has identified SSSIs where silt removal is urgently needed to meet PSA target. This expensive programme will need special funding.
	Environment Agency has agreed to set maximum stocking densities for bream and carp on stillwater SSSIs.	Turbidity of lakes due to bottom-feeding fish can lead to eutrophication. Removal may be only option on some SSSIs to meet PSA target.
	Voluntary initiative on pesticides began in 2001: includes pilot projects on water pollution. Crop Protection Plans have biodiversity measures.	Initial results of pilot projects inconclusive. Need for more demanding targets and better incentives.
	Research by the Environment Agency and others into endocrine disrupters entering rivers in sewage effluent.	Research has shown feminisation in fish. It is not yet clear whether populations are affected.
Water abstraction	Water company investment, under the Asset Management Programme, in alternative sources for abstractions affecting SSSIs. Started in 1998 with closure of borehole at Redgrave and Lopham Fen NNR in Suffolk.	19 schemes and 27 investigations agreed to date. Remaining relevant licences need to be modified by 2010 to meet PSA target.
	Review by Environment Agency of all licences affecting Natura 2000 sites under the 1994 Habitats Regulations. Flow targets agreed with English Nature for SAC rivers.	Review due for completion on priority sites by 2006. Need for Environment Agency to agree flow targets for designated rivers and incorporate in Catchment Abstraction Management Strategies.
	Water Act 2003. All new abstraction licences to be time-limited. Ending of compensation for revocation of licences on the grounds of causing serious environmental damage in 2012.	Time limiting of licences will allow regular review, and possible non-renewal. Requirement to pay compensation has prevented revocation and rationalisation of licences to date. Licenced water suppliers will be required to contribute to water undertakers' drought and water resources management plans.
	The Environment Agency 'Restoring Sustainable Abstraction' project started in 1997 and includes non-designated sites.	
	Water transfers by canal: agreement reached between British Waterways and English Nature after House of Commons Select Committee enquiry in 2002. Water Act 2003 will generally require licensing of transfers into canals.	Transfers likely to be local and subject to environmental assessment.

continued »

Type of pressure	Actions taken	Comments
Invasive species	Defra review of non-native species policy 2003.	
	Awareness raising: leaflets on alien crayfish and invasive plants by English Nature and the Environment Agency.	
	Action on Australian swamp stonecrop: RHS will not stock at its garden centres. Control programme instituted by English Nature at five lakes in 2003.	Diquat alginate withdrawn from use by EU in 2003; this was most effective control method.
	Import of Live Fish Act 1978 operated by Defra and licences to stock fish operated by the Environment Agency under the Salmon and Freshwater Fisheries Act 1975. Byelaw prohibiting live baiting in Lake District (2002).	These two statutes along with Section 14 of the Wildlife and Countryside Act 1981 mean that keepering and release of non-native fish requires a licence. English Nature is investigating with Defra whether import itself could be banned without infringing GATT rules.
Recreation	Memoranda of understanding signed by English Nature in 2003 with the National Angling Alliance and the British Canoe Union.	Working together to improve water quality and promote the conservation and understanding of wildlife and water.
	English Nature working with British Waterways to promote wildlife conservation on the canal network, including restoration schemes, eg Rochdale Canal SAC 2002.	Remainder canals often provide havens for wildlife that has disappeared from the surrounding countryside. Development of SSSI stretches (only 1% of canal network) should be limited to that which is compatible with conserving their wildlife.
	English Nature commissioned research in 2003 on access and recreation on SSSIs. Defra research in 2001 showed that SSSI waters had greater access than the generality of water bodies.	Greater public access to river and lake SSSIs should not cause a problem, provided that this is limited to quiet recreation, especially in the bird breeding season.

Annex 2

Regional examples of current achievements in delivering wildlife at the landscape scale	
Issues that can meet nature conservation objectives at the landscape scale	**Examples of current achievements**
Sustainable agriculture In response to the recommendations of the Sustainable Food and Farming Strategy, Regional Steering Groups and Environment Working Groups have been established. These have developed regional targeting in order to assist the integration of biodiversity delivery into rural programmes. In addition, regional farm advice services are being developed. The England Rural Development Plan has steering groups in each region, and there is a wide variety of projects supporting the farming industry. There are many projects operating at a more local level, such as changing farm practices that save time and money whilst benefiting the environment through, for example, soil conservation measures.	In Yorkshire & Humberside a project is targeting agri-environment schemes according to Joint Character Area priorities. In the North West and South West, steering groups are developing regional farm advice services. The England Rural Development Plan has regional steering groups supporting the farming industry through a number of projects, including: • North West Farm Facilitation Pilot; • Cumbria Rural Regeneration Company; • South West Chamber of Rural Enterprise. The Test and Itchen Landcare Initiative in the South East demonstrates how land managers can change farm practices to save time and money whilst benefiting the environment through using, for example, soil conservation measures.
Wetland management and creation Wetland habitat creation projects and management of floodplain washlands are key areas of regional activity. Most projects involve a range of partners, and the wetlands being created not only contribute to biodiversity habitat and species targets but also link to local communities, economies and public enjoyment. They aim to bring an holistic approach to the management and enhancement of the natural, cultural and historic environment of a region's strategic river corridors, together with their regeneration and economic development, to the benefit of people, wildlife, landscape, townscape and the management of flood risk. In the urban context, the development of a Green Grid can use flood management as a key driver, to deliver river restoration and wetland creation linked to sustainable urban drainage.	The Severn and Avon Vales Wetlands Project, in the West Midlands and South West Regions, is successfully restoring historic floodplain landscapes linked to wetland biodiversity restoration and re-creation targets, through the promotion of sustainable farming partnerships. Similar washland and wetland creation projects are underway in Yorkshire and Humberside. The East Midlands Strategic River Corridor initiative will bring an holistic approach to the management and enhancement of the natural, cultural and historical environment of the region's strategic river corridors. Their regeneration and economic development will benefit people, wildlife, landscape, townscape and the management of flood risk. In the North West, a major 'Peatlands for People' project is delivering lowland raised bog restoration on the Solway and Duddon mosses, and developing links to local communities, economies and public enjoyment. The development of a Green Grid in Thames Gateway London has flood management as a key driver, and will deliver river restoration and wetland creation linked to sustainable urban drainage.
	continued »

Issues that can meet nature conservation objectives at the landscape scale	Examples of current achievements
Sustainable tourism Wildlife and natural features are fundamental to the development of sustainable tourism. This was given special impetus in the North East and South West, where the tourism economy had particularly suffered from the impact of the foot and mouth epidemic. In these two regions, sustainable tourism and nature-based tourism ideas are being developed. Elsewhere, recreation and tourism projects, based on a high quality environment, are being used to drive economic regeneration.	Sustainability South West has produced two documents: - *Future Footprints*, a framework for achieving sustainable tourism in the South West; - *21st Century Tourism*, South West Tourism's Sustainable Tourism Strategy.
	The North East Regional Development Agency is working, in partnership, on nature-based tourism, concentrating on four key areas: visitor management, environmental management for small businesses, Green Guiding schemes, and Visitor Payback schemes.
	The West Midlands Regional Development Agency is progressing two projects, *Growing Green Tourism* and *Unlocking the Potential of Nature Reserves* through their Rural Regeneration Zone Implementation Plan to drive the economic regeneration of the rural west of the Region.
	Taking place in London and the East of England, Green Arc is an initiative aimed at improving ecological links and access to the Green Belt in the north and east of London.
Renewable energy Renewable energy strategies currently being prepared include developing markets for forestry products and projects providing sustainable woodland management that combine ecological benefits with socio-economic outcomes. In addition, windfarm developments are an emerging theme within a number of regions.	The North West Regional Assembly has prepared a regional Renewable Energy Strategy, and similar strategies are being prepared for the East Midlands and North East.
	The South East Wood Fuel Networking Group is developing markets for forestry products. This Group, made up of regional and sub-regional organisations, is working to deliver an action plan for wood fuel development. This plan has the potential to contribute to national targets, such as the England Forestry Strategy and the SSSI PSA target, as well as to the implementation of the Regional Renewable Energy Strategy.
	In the West Midlands, the Heartwoods Project provides support to small and medium enterprises and to new business start-ups in the wood supply chain. The project provides a means to facilitate and implement policy objectives for sustainable woodland management in ways that combine ecological benefits with socio-economic outcomes.

Acknowledgements

This report has drawn extensively on a wealth of published work and many success stories. We thank and acknowledge the efforts of all those who have contributed in this way. Their actions have greatly assisted the preparation of this document.

We would like to thank English Nature Council Members, particularly Ms Melinda Appleby, Professor Malcolm Hart, Mrs Anne Kelaart, Professor David Macdonald and Dr Anne Powell for their support and advice. Many staff within English Nature have contributed their time and expertise, and spent much time commenting on early drafts and we are very grateful for this. We also thank officers from a range of organisations who commented on early drafts of this work, especially Mark Avery (RSPB), Jeremy Biggs (Ponds Conservation Trust), David Brook (ODPM), Nick Collinson (Woodland Trust), David Howard (Centre for Ecology and Hydrology), Iain Rennick (Scottish Natural Heritage), and Neil Weatherley (Environment Agency), and staff within Defra particularly John Osmond, Ian Barrett, Joanna Davies, Daniel Instone, Hilary Neal, Jonathan Newman, Gy Ovenden, John Robbins, Mark Rosenberg, Huw Thomas, Mike Walker and Ken Wright. Their comments have improved the clarity of this report, and we are grateful for all their contributions.

Thanks also to all the photographers, particularly Stephen Davis and Peter Roworth of English Nature, to BTCV for photographs, and to Status Design and Advertising for working long hours to design an excellent report.

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ENGLISH NATURE

English Nature is the Government agency that champions the conservation of wildlife and geology throughout England.

This is one of a range of publications published by:
External Relations Team
English Nature
Northminster House
Peterborough PE1 1UA

www.english-nature.org.uk

Printed on Evolution Satin, 75% recycled post-consumer waste paper, Elemental Chlorine Free.

ISBN 1 85716 783 X

Catalogue code CORP1.54

Designed and Printed by
Status Design & Advertising, 4M.

Front cover photographs:
Top left: Cirl bunting.
Mike McKavett/Windrush Photos
Bottom left: Spangled water beetle *Graphoderus zonatus*.
Roger Key/English Nature
Main: North Meadow, Cricklade NNR, Wiltshire.
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