Snapshots of the Environment

ENVIRONMENT AGENCY

The National Centre for Environmental Data and Surveillance

ENHANCING BIODIVERSITY

1.0 Introduction

1.1 The **Snapshots of the Environment** series explores some of the issues related to each of the nine **Themes** identified in the recent Environment Agency publication **'An Environmental Strategy for the Millennium and Beyond'**. Each Snapshot uses the **Viewpoints on the Environment** to look at the state, and the **Stresses and Strains** framework to look at some of the pressures on the environment. The third Snapshot in the series focuses on **Enhancing Biodiversity**.

1.2 Given the wide range of potential topics and the restricted space, these Snapshots can only touch upon some of the issues and cannot be a comprehensive review. As more information becomes available, or new issues develop, they will be covered in future Snapshots. An important aspect of the Snapshots is that they will look at issues that can be followed across the nine Themes covered in the series.

1.3 This third Snapshot looks at some aspects of habitat loss and fragmentation and habitat quality decline. A guide to the acronyms used is provided at the end of the document.

2.0 Biodiversity

2.1 In January 1994 the Government published the Biodiversity Action Plan. In 1995 a Biodiversity Steering Group published a set of proposed specific, costed targets and action plans for 116 priority species and 14 key habitats of conservation importance. The habitat plans cover about 2% of the United Kingdom (UK) land area. A revised and increased list of both species and habitats is about to be produced. The agreed targets and action plans will form the basis for conservation action in the UK for many years (DOE, 1996). By playing a full part in delivering the UK's Biodiversity Action Plan (UK BAP) the Environment Agency will help to enhance biodiversity both in terms of habitats and species.

Climate change

2.2 Biodiversity in the United Kingdom largely reflects the influence of the last ice age, and climate change continues to be an important natural stress. Current predictions suggest that by the year 2050 the UK may be on average 2°C warmer, with up to 10% more rainfall. The sea level may also rise by 20cm (May, 1997). Two types of effect are envisaged. The first of these are direct effects on ecosystems. Ecosystems are a result of the interactions between the species that inhabit particular habitats. The relationships between these species and habitats are often complicated and key to the survival of the ecosystem - as such the response of an ecosystem to any perturbation is likely to be complex. On occasions a stress may only affect a single species within a habitat, leaving the habitat largely unchanged. Where that species is key to the integrity of that ecosystem - "a keystone species" - the whole community may be affected. Ecosystems will respond to changes in temperatures, the incidence of frosts, moisture availability and to changes in the concentration of carbon dioxide. If you accept that the temperature will increase in a northerly direction (May, 1997) then two types of scenario are possible. Those species at the southern limit of their range, eg. dotterel in montane habitats, may become extinct in Britain. Conversely, those species at the northern limit of their distribution or those susceptible to frost damage (Dartford warbler or chalk hill blue butterfly) may increase in population size. Wetlands in the east and north and upland blanket bogs could become drier, favouring colonisation by grasses and trees.

2.3 More immediate, and perhaps more obvious, are the stresses caused by a variety of man's activities. The United Kingdom has wide variety of wildlife. Within this relatively small area, large variations of habitats and species exist and as a result the stresses and strains on each of them are many and varied. Water and mineral abstraction has led to the loss of habitats and species, and significant areas of the countryside are impacted by discharges to air and water causing problems such as acidification and eutrophication. Societal influences, such as the demand for additional land for housing and infrastructure developments, are also having an impact. The rest of this paper will examine two of the major losses of biodiversity within the United Kingdom; **habitat loss and fragmentation** and **habitat quality decline**.

3.0 Habitat loss and fragmentation

3.1 Farming practices, built development, woodland management, land drainage and water abstraction have all caused, or are currently resulting in, a direct loss or

fragmentation of habitat. (UK BAP Vol.1, 1995) . There are many examples of habitat loss including; 95% loss of neutral grassland including hay meadows since 1930, 80% loss of calcareous grassland since 1940, 40% loss of lowland heath since 1950 (84% since 1800), 48% loss of grazing marsh in the North Kent marshes since 1935, 50% loss of fens and mires since 1950 (EN, 1996(1)). The UK BAP states that "The fragmentation or isolation of key habitats is to be avoided and wherever practicable past fragmentation to be reversed" (UK BAP Vol.1, 1995).

Farming

3.2 About 77% of the UK's land surface is in farming use. Changes in farming practice, particularly the trend to regional specialisation and more intensive management of crops and pasture, have led to the widespread loss of many semi-natural habitats such as heathland moorland, hay meadows and wetlands. This has reduced the value of much of this productive land to wildlife. Some farming practices do, however, create new and different habitat areas and thus contribute to the changes which result from an increasingly 'managed' environment.

3.3 Another important impact of farming is the loss of farmland features, such as hedgerows, dry stone walls, ancient trees, copses, ponds, ditches and small wetlands (UK BAP Vol.2, 1995). Hedgerows are a primary habitat for at least 47 extant species of conservation concern in the UK, including 13 globally threatened or rapidly declining ones. They are especially important for butterflies and moths, farmland birds, bats and dormice. Over 600 plant species, 1,500 insects, 65 birds and 20 mammals have been recorded at some time living or feeding in hedgerows. Hedgerows may also act as wildlife corridors for many species, allowing dispersal and movement between other habitats.

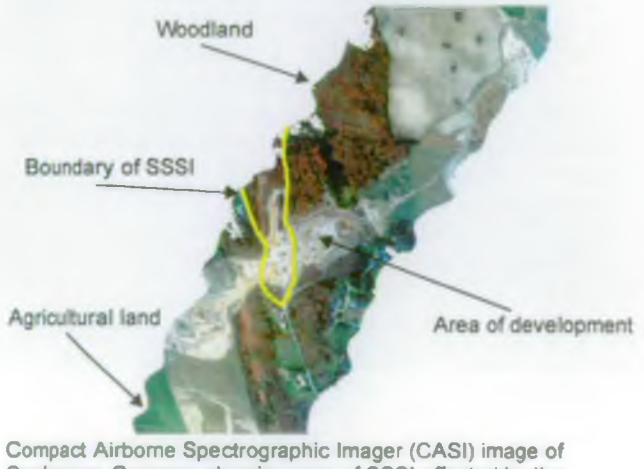
Length of hedgerows and dry stone walls. (Note there were no data for walls from 1993)

3.4 In 1993 the DOE commissioned a survey of hedgerows. It was estimated that about 329,000km of hedgerow remained in England and 49,000km in Wales. Since 1945 there has been a drastic loss of hedgerows through removal and neglect. Between 1984 and 1990, the net loss of hedgerow length was 21% in England and 25% in Wales. The loss was the result of a combination of outright removal (1.7% per annum) and neglect (3.5% per annum). In England and Wales the loss continued between 1990 and 1993, with neglect becoming increasingly important and removal less so (DETR, 1997).

3.5 Dry stone walls provide a habitat for a wide range of flowering plants, ferns, mosses and lichens adapted to rock habitats. A wide range of invertebrates, reptiles, birds and mammals use dry stone walls for feeding, breeding or shelter. There are an estimated 112,500km of dry stone walls in England, half of which are described as derelict. Estimates of the loss of dry stone walls vary between 7,000km lost in the period 1947-1985, through to 40,000km lost in England and Wales in the last 20 years. The loss of hedgerows and dry stone walls by direct destruction, to create larger fields, has slowed and some increase in hedgerow extent is now taking place. A large part of the hedgerow and wall resource is unmanaged. Management of these features is essential to their integrity. Article 10 of the European Community (EC) Habitats Directive requires member states to encourage the management of hedges and dry stone walls. Grant aid for the restoration and planting of hedges is provided under the Countryside Stewardship Scheme (UK BAP Vol.2, 1995).

Built development

3.6 Currently, 10.6% of the land surface of the UK is in urban use (DETR, 1997). These areas are discontinuous, containing areas which can contribute to biodiversity such as open land in parks, open spaces, road corridors and private gardens. Development has a direct impact on biodiversity when it damages or destroys valuable wildlife habitats. One measure of this is damage to Sites of Special Scientific Interest (SSSI) as recorded by English Nature and the Countryside Council for Wales (DETR, 1997). In a recent survey of the condition of SSSIs two cases where irrecoverable damage occurred were noted.



Compact Airborne Spectrographic Imager (CASI) image of Snelsmore Common showing area of SSSI affected by the construction of the Newbury bypass.

Approximately 1ha of woodland associated with the Newbury bypass and 0.9ha of grazing marsh at Chichester harbour were destroyed as a result of built development.

3.7 Lowland heath is a scarce habitat which supports a wide range of rare plants and animals. In England only one sixth of the heathland present in 1800 now remains. Fragmentation and disturbance from developments such as housing and road constructions are some of the factors affecting the habitat at present.

Location of lowland heathland in England

3.8 Development of transport infrastructure also affects biodiversity through loss of habitat. Changed verge management, replacement of roadside ditches by buried drains, road construction and the upgrading of existing roads can cause loss of, and damage to, wildlife habitats. There are also impacts through increased demands for aggregates, increased pressure for adjacent development, and through the substantial contribution transport makes to greenhouse gas emissions and acid rain.

3.9 In order to protect habitats of special conservation value it is essential to know their distribution. The extent of designated sites such as SSSIs in England and Wales is known and can be compared with proposed sites for development. Inventories also exist for habitats such as lowland heathland, grassland etc. Under the UK BAP the distributions of all habitats and species of concern have to be defined. It will be essential to compare these with any proposed areas of development or any of the other stresses affecting biodiversity.

Woodland management

3.10 Woodland covers only 7.5% of the land surface area of England (EN, 1996(2)). All woodlands and forests have some value for wildlife, but the remains of 'natural' forest cover (the ancient semi-natural woodland) are the most valuable and diverse, and are of special importance because they cannot be easily replaced. There has been a gradual loss of forest cover and associated biodiversity in the UK, which fell to its lowest level of 5% of the UK's area at the start of this century. Today, 10% of the UK land area is covered by forests, with ancient and semi-natural woodland covering only 1.4% of the total wooded area, much of which is greatly fragmented.

3.11 The replacement of native broadleaved trees by both native and introduced conifer species has also resulted in a reduction of biodiversity. Forest cover in Great Britain (GB) has increased from 1.8 million hectares in 1970 to 2.4 million hectares in 1995, 64% of which is mainly conifer (DOE, 1996). The stands are usually of a single species, typically sitka spruce (40%). These plantations were often planted where habitats with higher biodiversity such as broadleaved and yew woodland, heath, moor and bog habitats once existed. There has been a stabilisation in conifer forest cover in recent years and a decline in new conifer plantings. The marked increase in new plantings of indigenous broadleaved species since 1985 follows the introduction of the Broadleaved Woodland Grant Scheme and its successor the Woodland Grant Scheme in 1988.(DETR, 1997)

3.12 The Forestry Commission has an inventory of all types of woodland which, together with the Countryside Surveys (CS1990) carried out by the Department of the Environment (DOE), provides detailed information about woodlands and their management.

Land drainage and water abstraction

3.13 The loss of wetland, through drainage or water abstraction, is a limiting factor for a number of habitats. Freshwater and bog habitats are subject to habitat fragmentation, leaving small populations vulnerable to extinction and leading to genetic isolation. Examples of habitats identified under the UK BAP as threatened by water abstraction include reedbeds and chalk rivers. There are about 5,000ha of reedbeds in the UK, but of the 900 sites contributing to this total, only about 50 are greater than 20ha (UK BAP Vol.2, 1995). Reedbeds are amongst the most important habitats for birds in the UK, including 6 nationally rare Red Data birds such as the bittern.

3.14 There are approximately 35 chalk rivers and major tributaries ranging from 20 to 90km in length, located in south and east England (UK BAP Vol.2, 1995). All chalk rivers are fed from groundwater aquifers, producing clear waters and a generally stable flow and temperature regime. These are conditions which support a rich diversity of invertebrate life and important game fisheries, notably

for brown trout. Excessive abstraction mainly for public water supply has contributed to low flows on a number of chalk rivers. This has lead not only to drying out of the upper sections and riparian zones, but also to the accumulation of silt and changes in the aquatic vegetation structure. About 30 rivers, fens and lakes have been recognised nationally as suffering from 'low flows' or low water levels due to over use. There are 28 SSSIs which are affected by abstraction, eight of which are riverine SSSIs.

Location of 'low flow' rivers (1997) and wetland sites (1994-1996 as derived from the river habitat survey)

3.15 Through the licensing of abstractions the Environment Agency can review consents and licenses during Catchment Management Plans. Where abstraction is found to be damaging the quality of habitats, the Environment Agency can consider revoking the licenses. Biodiversity benefits will also result from the Asset Management Plans programme (AMP3) for the water industry, which includes proposals to address over-abstraction at more than 15 chalk river sites. Another way of protecting reedbeds, fens and other wetlands is the formation of a water level management plan (WLMP), which aims to balance and integrate the needs of agriculture, flood defence and conservation. Where possible the management promotes conditions favourable to wintering and breeding birds, and for characteristic wetland plants and invertebrates.

4.0 Habitat quality decline

4.1 As well as the obvious loss of biodiversity associated with loss of habitat, biodiversity can be affected by a decline in habitat quality. Some of the main causes of habitat quality decline include falling water quality, airborne pollution and insecticides affecting birds and bats.

Water quality

4.2 Within the species action plans of the UK BAP, 32 of the 116 species will benefit, as a result of improved water quality enhancing the habitats in which they occur (UK BAP Vol.1, 1995). Ecosystems are affected by point or diffuse pollution arising from effluent from sewage treatment works, industrial processes, leaching from old and unused mines, agricultural practices and chemical spills.

4.3 The otter provides a good indicator of overall river quality. Once widespread, the otter underwent a rapid decline from the 1950's to the 1970's. This decline was attributed to the use of highly toxic, persistent organochlorine insecticides and as a result of persecution. A ban on the use of organochlorine insecticides (1962-1983) and the provision of legal protection (1978-1982) have resulted in an increase in the numbers of otters in England and Wales. This increase, coupled with known low levels of organochlorines in rivers, suggests that water quality may no longer be a limiting factor to the recolonisation of otters.

The rivers and watersheds of England known to be occupied by otters in 1991-1994

4.4 The most common pressure on biodiversity, in terms of water quality, is that posed by fertiliser run-off and the effluent from sewage treatment works leading to nutrient enrichment and eutrophication. Many rare or endangered species are particularly sensitive to the effects of nutrient enrichment including vendace, crayfish and freshwater pearl mussel. Chalk rivers provide an example of an aquatic habitat affected by fertiliser run-off, with high levels of nutrients causing excessive growth of blanket weed and other changes in the plant communities. The nutrients which predominately contribute to this enrichment are nitrate and phosphorus. The main source of nitrate and a large portion of the phosphorus in UK freshwater is leaching from agricultural land. Reductions in nitrates leaching into water from agriculture will result from the Nitrate Directive and the designation of Nitrate Vulnerable Zones. The effects of nutrient enrichment can also be observed in estuaries where increases in the growth of green algae such as *Enteromorpha* sp. are common in areas with agricultural run-off. This can result in a smothering of the intertidal mudflats

and associated problems such as lack of available foraging areas for wading birds.

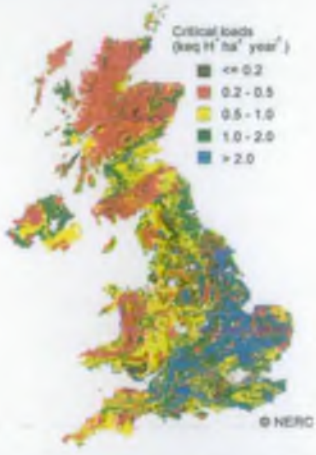
CASI image of Langstone Harbour showing areas covered by green algae.

4.5 The non-statutory River Quality Objectives and statutory Urban Waste Water Treatment Directive (UWWTD) (91/271/EEC) standards provide the framework for improving water quality. The Directive requires nutrient reduction treatment by December 1998 for large sewage treatment works (STWs) discharging into waters identified as Sensitive Areas (eutrophic). The government has designated 33 such areas (as freshwater) and phosphorous removal at some 41 STWs will be required.

4.6 Current monitoring schemes provide data on the levels of specific pollutants within aquatic systems. A more useful indicator of water quality with respect to nutrient enrichment is the biology of the river, canal or standing water. The existing river quality 'General Quality Assessment' (GQA) scheme has a biological window and the Environment Agency is developing a scheme for describing the trophic state of rivers in order to assess the impact of eutrophication. The principal aim of the Mean Trophic Rank for macrophytes is to help identify candidates for designation as Eutrophic Sensitive Areas under UWWTD. Currently, Directives used to address nutrient enrichment are based on water quality, but with the potential implementation of the Water Framework Directive, there will be increased emphasis on the biology/ecology of a system. Where habitats are affected, procedures will be implemented to address the causes. Along with eutrophication, future pressures on water quality will come from areas such as the use of pesticides, soil erosion, the disposal of industrial solvents, urban and road run-off and the problems associated with abandoned mines.

Airborne pollution

4.7 There have been major changes in UK air quality since the 1950s. Widespread coal burning in the home has declined substantially with the move to cleaner fuels such as gas and electricity. Cleaner fuels, less polluting processes and pollution abatement equipment have all contributed to lower emissions from industry. Motor traffic has increased substantially and now vehicles are a major source of pollutants in urban areas (DOE, 1996). The main effect of this pollution is acid rain, and the contribution to climate change, due to CO_2 emissions. Habitats and species are affected by nitrogen and sulphur dioxides, carbon dioxide and monoxide and other volatile organic compounds. Critical loads can be used to show the areas adversely affected by acid rain, low level ozone or other pollutants. These are estimates of exposure to pollutants below which significantly harmful effects on sensitive elements of the environment are unlikely to occur. For a particular effect such as acid damage to trees, or eutrophication, critical loads can be mapped and are prepared by the DETR's Critical Loads Advisory Group (CLAG), based at the Institute of Terrestrial Ecology (ITE). There are currently large parts of the UK where terrestrial and freshwater ecosystems are at risk of acidification, eutrophication or ozone damage as a result of air pollution.



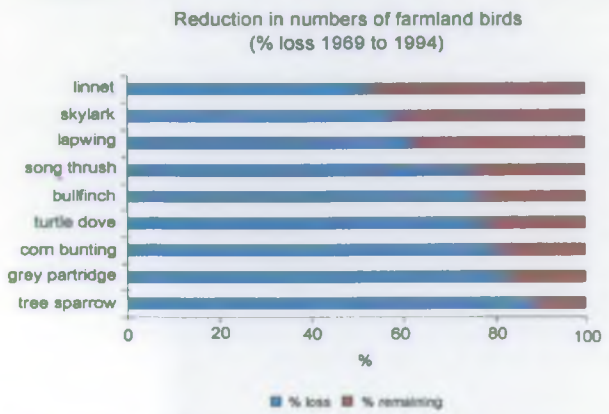
Critical loads for the deposition of acidity to soils

4.8 The reductions in authorised sulphur dioxide emissions to the atmosphere proposed in the current review of the electricity supply industry will, by 2005, reduce by 43% the area where critical loads are exceeded. This will enhance biodiversity, to the benefit of priority habitats such as lowland heath and blanket bog. Examples of other habitats at risk include upland oakland, especially on lichen and bryophyte communities, broadleaved and yew woodland, standing open waters, rivers and streams.

Insecticides affecting birds and bats

4.9 One of the greatest conservation problems in the UK today is the continuing loss of biodiversity from lowland farmland. In addition to air pollution, the use of pesticides and fertilisers on farmland is thought to cause damage to such ecosystems. The causes of the rapid decline of several species of farmland bird such as the skylark, grey partridge and song thrush and the pipistrelle bat are not fully understood. The extent of the avian declines is known as a result of a long-term monitoring scheme, the Common Bird Census (CBC), which was initiated in the early 1960s by the British Trust for Ornithology (BTO). Three main factors have been cited to explain this decline: 1) loss of winter food through the switch from spring- to

autumn-sown cereals; 2) loss of nesting sites as more land has come into production from non-farmed habitat such as hedgerow and loss of food for chicks; and 3) current research suggests that numbers may have been affected by the increased use of agro-chemicals, reducing prey availability.



The species affected all feed on insects or rely on insects to provide prey for their offspring. Increased use of pesticides has reduced the availability of invertebrates both directly (in the case of insecticides) and indirectly (in the case of herbicides which reduce insect food). The loss of these species has been paralleled by a general decline in biodiversity (RSPB, 1995).

4.10 Changes in agricultural policy including set-aside and the increase in organic farming may help to alleviate some of the problems. Nearly 600,000ha of land are now set-aside in the UK as part of the Common Agricultural Policy (CAP) reforms. The introduction of set-aside, on a voluntary basis in 1988 and subsequently as a compulsory measure under the 1992 CAP reforms has yielded some environmental benefits such as increases in the UK cirl bunting population (RSPB, 1995).

Bibliography

Beyond 2000 English Nature's strategy for improving England's wildlife and natural features. English Nature (1997) ISBN 1 85716 276 5

Biodiversity : The UK Steering Group Report Volume 1 : Meeting the Rio Challenge (1995)

Biodiversity : The UK Steering Group Report Volume 2 : Action Plans (1995)

Digest of Environmental Statistics No.19. 1997 Dept of the Environment, Transport and the regions. The Stationary Office, London.

English woodland and nature conservation. English Nature 1996 (2). ISBN 1 85716 209 9

Habitat Restoration Project. English Nature 1996 (1) ISBN 1 85716 247 1

Indicators of Sustainable Development for the United Kingdom Department of the Environment 1996.

May, R (1997) Climate Change. A note by the Chief Scientific Adviser. Office of Science and technology

RSPB Conservation Review 1995 (9)

Acronyms

AMP3 - Asset Management Plans
BTO - British Trust for Ornithology
CAP - Common Agricultural Policy
CASI - Compact Airborne Spectrographic Imager
CBC - Common Bird Census
CLAG - Critical Loads Advisory Group
CMP - Catchment Management Plans
CS 1990 - Countryside Survey 1990
DETR - Department of Environment, Transport and the Regions
DOE - Department of the Environment
GB - Great Britain
GQA - General Classification Scheme
HS 1993 - Hedgerow Survey 1993
ITE - Institute of Terrestrial Ecology
RSPB - Royal Society for the Protection of Birds
SSSI - Site of Special Scientific Interest
STW - Sewage Treatment Works
UK - United Kingdom
UK BAP - United Kingdom Biodiversity Action Plan
UWWTD - Urban Waste Water Treatment Directive
WLMP - Water Level Management Plan

For further information contact:

The Environment Agency
National Centre for Environmental Data and Surveillance
Lower Bristol Road
Bath, BA2 9ES

Tel: 01278 457333
GTN: 724 4223
Fax: 01225 469939

E-mail david.palmer@environment-agency.gov.uk

Website http://www.environment-agency.gov.uk

Other Snapshots in the series:

Snapshot 1: A new environmental approach
Snapshot 2: Conserving the land

ENVIRONMENT AGENCY