

Mendip Hills

Natural Area profile

January 1998

Foreword

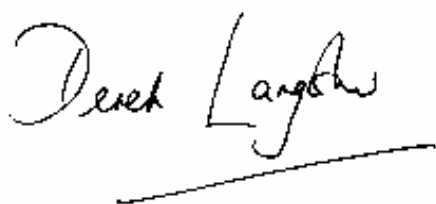
One of the key components of English Nature's *Strategy for the 1990s* has been the Natural Areas approach. We examined the local distinctiveness of each part of England, to identify their characteristic wildlife and natural features, and used this to define a comprehensive series of Natural Areas. Their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

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

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

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

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

A handwritten signature in black ink, reading 'Derek Langslow'. The signature is written in a cursive style. Below the signature is a horizontal line that starts under the 'D' and extends to the right, ending under the 'w'.

Dr Derek Langslow
Chief Executive

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1. Context

1.1 Natural Areas and the *UK Biodiversity Action Plan*

In June 1992 the Prime Minister and over 150 other Heads of State or Governments signed the Convention on Biological Diversity at Rio de Janeiro. They did so to express a shared belief that action must be taken to halt the world-wide loss of animal and plant species and genetic resources. At the same time they agreed to draw up national plans and programmes and to share resources to help implement them. This resulted in the first UK Biodiversity Action Plan published in 1994 (Box 1).

The Plan commits the Government to the objectives of the Convention but, just as its production required a wide ranging and vigorous contribution from people and organisations who care about our natural environment, so delivering it will require active participation. The Government can take a lead and establish a framework but whether, in the end, we and our children enjoy a country which is richer or poorer in species and habitats depends on all of us (Department of the Environment, 1994).

English Nature, as the Government's statutory advisors on nature conservation in England, have a key role to play in stimulating action. The development of the Natural Areas concept is an important part of that role (Box 2).

A Natural Area is not a designation, but an area of the countryside identified by its unique combination of physical attributes, wildlife, land use and culture. These features give a Natural Area a "sense of place" and a distinctive nature conservation character which we can seek to sustain (EN, 1993¹). The concept is based on wide participation and enables us to "Think Globally, Act Locally".

BOX 1: UK Goals, principles and objectives

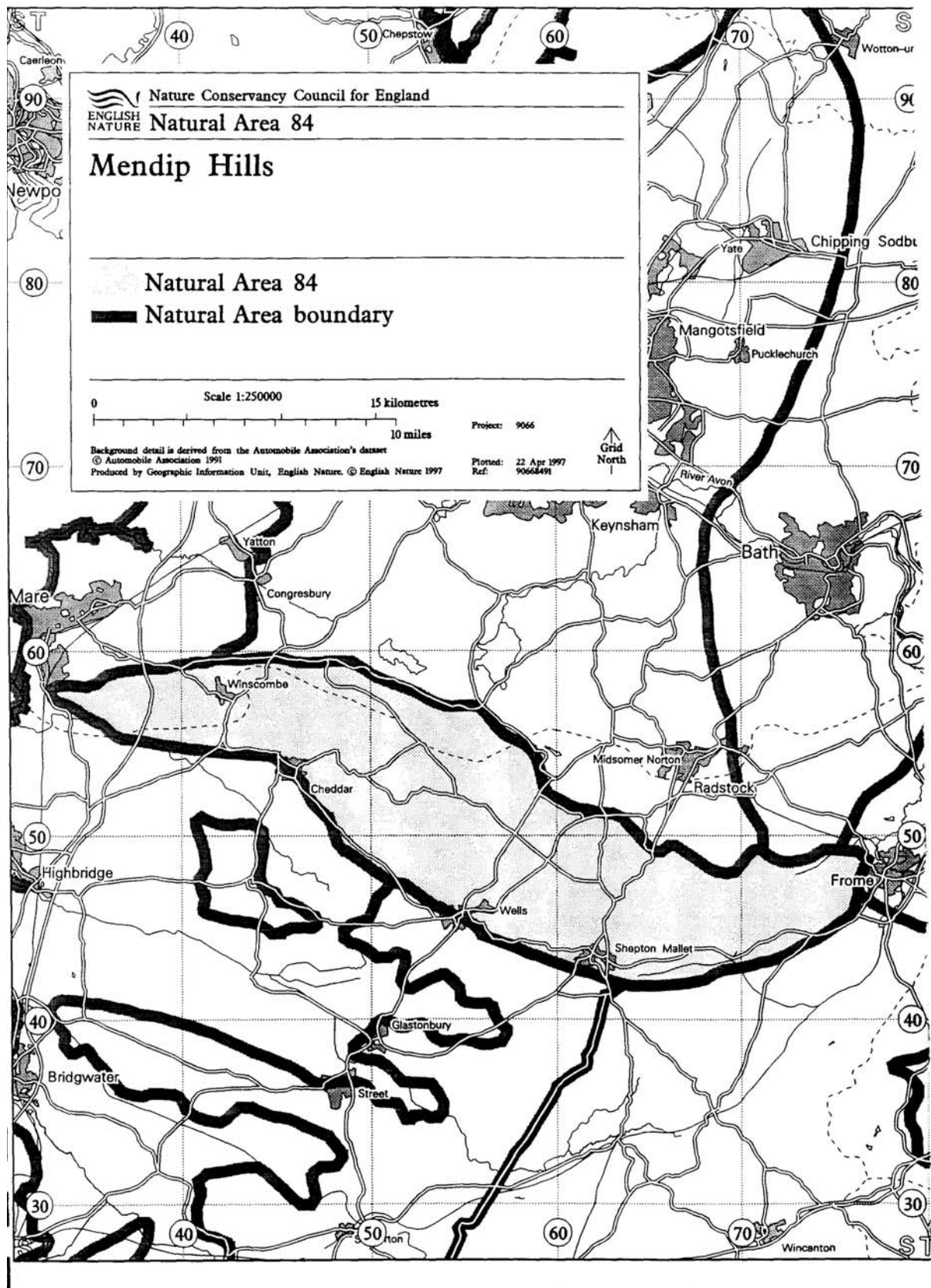
- Overall goal
to conserve and enhance biological diversity (the variety of life) within the UK and to contribute to the conservation of global biodiversity through all appropriate mechanisms.
- Underlying principles
 1. Where biological resources are used, such use should be sustainable.
 2. Wise use should be ensured for non-renewable resources.
 3. The conservation of biodiversity requires the care and involvement of individuals and communities as well as Governmental processes.
 4. Conservation of biodiversity should be an integral part of Government programmes, policy and action.
 5. Conservation practice and policy should be based upon a sound knowledge base.
 6. The precautionary principle should guide decisions.

- Objectives for conserving biodiversity
 1. To conserve and where practicable enhance:
 - a) the overall populations and natural ranges of native species and the quality and range of wildlife habitats and ecosystems
 - b) internationally important and threatened species, habitats and ecosystems
 - c) species, habitats and natural and managed ecosystems that are characteristic of local areas
 - d) the biodiversity of natural and semi-natural habitats where this has been diminished over recent past decades.
 2. To increase public awareness of, and involvement in, conserving biodiversity.
 3. To contribute to the conservation of biodiversity in a European and global scale.

BOX 2: The Natural Areas concept

- A Natural Area is a tract of the countryside which can be identified by its physical, wildlife and land use features.
- Physical features are determined by the geology, landform, soils, climate and drainage.
- Wildlife features are determined by the habitats and species of flora and fauna.
- Land use features are derived from past and present management activities.

1.2 The Mendip Hills Natural Area Map



2. Description

2.1 Physical features

The Mendip Hills are the most southerly Carboniferous Limestone Upland in Britain and are comprised of 3 major anticlinal structures, each with a core of older Devonian and Silurian rocks. The response of the limestone to weathering has resulted in a range of surface features, including gorges, dry valleys, screes and dolines. These are complemented underground by a large number of caves both beneath the plateau and at the base of the southern escarpment.

The Devonian and Silurian rocks are generally more resistant to weathering and form some of the highest points on the hills including Bleadon Hill, Black Down and North Hill near Priddy.

Springs, a number of which deposit tufa, are a particular feature of the eastern part of the hills.

In some areas the Carboniferous Limestone and the Dolomitic Conglomerate have been mineralised with lead and zinc ores. These areas have been the subject of a major mining industry in the past and this is reflected in areas of contaminated rough ground known locally as 'Gruffy'.

2.2 Habitats

There are three nationally important semi-natural habitats which are characteristic of the area:

1. Ash-Maple woodlands (often with abundant small-leaved lime);
2. Calcareous Grasslands;
3. Mesotrophic Grasslands.

These habitats are spread throughout the Natural Area but the woodlands and calcareous grasslands are largely confined to the steeper slopes. In addition there are areas of both acid and limestone heath, the former being largely confined to the Devonian sandstone outcrops.

2.2.1 Ash-Maple woodland

The majority of the ancient semi-natural woodlands found on the Mendip Hills fit into this category. They are typically found on the scarp slopes and valley sides and many have a long historical record. These woods are very diverse botanically and are the principle habitat for dormouse and purple gromwell.

Typical Plant Species in Ash-Maple Woodland in the Mendip Hills		
Canopy	Shrub	Ground
Ash	Hazel	Ivy
Pedunculate Oak	Hawthorn	Wood Anemone
Field Maple	Blackthorn	Sweet Woodruff
Small-leaved Lime	Spindle	Yellow Archangel
Wych Elm	Dogwood	Purple Gromwell
	Wayfaring Tree	Wild Daffodil
		Autumn Crocus
	Wild Privet	Early Purple Orchid
	Spurge Laurel	Harts-tongue Fern
	Crab Apple	To othwort
	Whitebeam	
	Ivy	
	Honeysuckle	
	Climbers	

Management of the woodland has been dominated by the practice of coppicing and many of the woodlands were considerably modified by the planting of oak in the 19th century.

2.2.2 Calcareous grassland

The calcareous grasslands of the Mendip Hills are largely confined to the steep slopes of the western and central areas. They are variable in character and change significantly in respect of their species composition from west to east.

Typical plant species of Calcareous Grassland in the Mendip Hills		
Wild thyme	Fairy flax	Somerset grass
Autumn ladies tresses	White rock-rose	Sheep's fescue
Common centaury	Rock rose	Quaking grass
Yellow wort	Honewort	Heath false-brome
Stemless thistle	Green-winged orchid	Upright brome
Carline thistle	Salad burnet	Meadow oat-grass
Squinancy wort		

Calcareous grasslands are very often associated with substantial areas of scrub, particularly where grazing has reduced. Typical scrub species are hawthorn dogwood, spindle blackthorn and wayfaring tree. Areas with mixed scrub and grassland are good habitats for a wide range of invertebrates and breeding birds.

2.2.3 Mesotrophic grassland

Once common on the plateau and in East Mendip these habitats have been significantly reduced by agricultural improvement. There are now few large sites, the habitat being represented mostly by a scattering of small fields. These areas remain under threat of improvement and are very vulnerable to changes in management.

Typical plant species in Mesotrophic Grassland in the Mendip Hills		
Betony	Crested dog's-tail	Twayblade
Cowslip	Red fescue	Sweet vernal-grass
Green-winged orchid	Pepper saxifrage	Quaking grass
Lady's bedstraw	Common knapweed	
Yellow rattle	Ox-eye daisy	

2.3 Species

The Mendip have a number of individual species of plant and animal which by virtue of their restricted distribution in England deserve special mention.

This is not a complete list of species in the area but includes some of the better known ones. A more extensive list is given in Annex 1.

Mammals

Dormouse: Restricted largely to coppice woodland and scrub this species occurs in large numbers on some sites.

Bats: The nationally rare lesser and greater horseshoe bats have a number of colonies in buildings, caves and mines in the area. Other species present are reliant on suitable buildings and old hollow trees to roost and breed in.

Birds

Peregrine Falcon: This bird has gradually recolonised the Mendips over the last 20 years. It breeds on sea and inland cliffs and also on the faces of both active and disused quarries.

Amphibians

Great crested newt: This species has a wide distribution across Mendip and is often found in flooded disused quarries.

Invertebrates

Large blue butterfly: This species became extinct in the late 1970s since when a research project has been undertaken into its ecology and reintroduction. A successful reintroduction has been made to a calcareous grassland in the Mendips.

Butterflies (general): The Mendips support a large number of butterfly species, particularly on the more extensive limestone grassland and scrub sites.

Species present include the national scarce pearl-bordered fritillary, Duke of Burgundy fritillary and in the woodlands. White-letter

hairstreak. All these species are at low levels and highly dependent on the sympathetic management of their respective habitats.

White-clawed
crayfish:

This nationally rare and declining species has a small population in a tributary of the Mells River.

Higher plants

Cheddar pink:

Occurs predominantly on cliff edges, rock ledges and in short turf within Cheddar Gorge. The species is confined to the Mendip Hills in Britain and is otherwise found in southern Europe.

Purple gromwell:

A characteristic plant of the Mendip ash-lime woodland frequently found in clearings and beside rides.

White rock-rose:

A plant of southern Europe found on coastal limestone cliffs only in Somerset and Devon.

Somerset hair-grass:

Found only in the County of Somerset this rare grass is confined to rocky outcrops in the western Mendips.

Starved wood-sedge:

Found only on a single hedge bank in the western Mendips, this species occurs at only one other site in England.

2.4 Geology

The Mendip Hills have an outstanding range of geological interests ranging from Silurian lavas and tuffs (volcanic ash), 430 million years old, to cave deposits only a few thousand years old. For a fuller description of Mendip geology please refer to Annex 2.

3. Influences and issues

3.1 The physical environment

The climate of the Mendip Hills is similar to much of southern Britain, cold winters are rare while summers range from cool and wet to hot, dry and sunny. In the extreme west of the Natural Area there is a recognisable maritime influence which affects the distribution of a number of plant species.

The relief of the area controlled by the resistance to weathering of the Devonian sandstones and Carboniferous Limestone has had a major influence on land use and the distribution of semi-natural habitats. The deeper soils of the plateau have generally been more intensively farmed as either arable or grass leys. It is for the most part only on the thinner soils of the escarpment that semi-natural habitats have been retained. These areas suffer significantly from drought in summer and are not capable of agricultural intensification.

The soils of the area range from thin skeletal soils directly over rock to the deeper soils of the Plateau which have in part been derived from windblown silt in periglacial conditions.

3.2 Traditional land use

The dominant use on the Mendips has been pastoral much of the plateau being grazed by dairy cattle while beef or sheep rearing has tended to predominate on the escarpments.

There has been a significant horticultural use made of the lower slopes of the southern escarpment, particularly in the growing of strawberries. This land use appears to be expanding with an increase interest in the product.

In recent years there has tended to be a decline in the grazing of marginal areas leading to problems from the growth of scrub on limestone grassland and heath.

Woodland

The Mendip Woodlands were managed to provide products for local consumption. A wide range of timber sizes were required, together with charcoal for domestic use. Woods in the east of the area would have provided mining timber for the Somerset Coalfield. The dominant management in the Mendip woods was that of coppicing to provide poles of various sizes and other products such as hurdles and faggots. Standard trees of oak would provide large dimension timbers for buildings.

Very few trees of great age are present in the Mendip woods, although some coppice stools are, because of their immense size, considered to be several centuries old.

3.3 Issues currently affecting nature conservation

In the Mendip woodlands the decline in coppicing and other woodland management has substantially altered their suitability for some species. Woodland butterflies, particularly the pearl-bordered fritillary have declined to near extinction. Coppicing dominantly for nature conservation has been reintroduced to a number of woodlands but has suffered badly from browsing by roe deer. The numbers of deer, of at least three species, present in the Mendip Woods appear still to be rising with the consequence that coppicing, without the protection afforded by a deer fence, may soon be impossible. Traditionally coppiced woodlands may have to be allowed to revert to high forest. The conversion of broadleaved woodland to conifers has not been a significant problem on Mendip but wooded areas are present that require management to return them entirely to broadleaves.

Changes in agriculture over the last 50 years has seen both a dramatic increase in the productivity of the better land, together with a decline in the use of marginal land. Vast tracts of steeply sloping land remain either ungrazed or at best only sporadically grazed. Most of the traditional hay meadows have been lost and scrub and bracken has invaded substantial areas of herb-rich calcareous grassland.

In recent years outdoor pig rearing has become a feature of the more marginal areas of the plateau leading to a loss of semi-natural grassland.

More intensive grassland management has also led to the filling of swallet holes on the Mendip plateau, together with the removal of a significant length of dry stone wall.

Quarrying of stone for building and in the case of limestone also for burning to produce lime has been a major feature of the Mendip Hills for centuries. During the latter part of this century, however, there has been a dramatic increase in both the size of the quarries and the volumes of stone extracted. Much of this stone is now transported by road and rail to distant markets. With a few notable exceptions quarries have not impacted greatly on important wildlife sites. This position may, however, change as older units are worked out and pressure for additional reserves increases.

In addition to their direct effects quarries can also result in the lowering of the ground water table in the surrounding area as they are pumped dry. This is known to cause the drying up of springs in the East Mendips.

3.4 Issues currently affecting geological conservation

1. Potential loss of geological exposures due to natural degradation of sites or infilling.
2. Maintaining existing geomorphological processes.
3. Damage to caves by overuse or misuse.
4. Over collecting of fossils in sensitive localities.

4. Objectives

4.1 To maintain all of the remaining semi-natural habitats in an optimal manner and expand the areas of important habitats

Rationale

The semi-natural habitats within this area are the repositories of its biodiversity and are the sole or principal habitats of all the important species.

It is, therefore, essential that the remaining semi-natural areas are not allowed to deteriorate further or be destroyed. Such losses would clearly result in a severe depletion of the natural capital of the Mendip Natural Area.

Key elements

- 4.1.1 Manage herb-rich calcareous grassland with appropriate grazing regimes to maintain the required sward structure and species composition.
- 4.1.2 Maintain or create a balance between calcareous grassland and scrub to sustain the maximum biodiversity. Where necessary actively control scrub.
- 4.1.3 Restore former areas of calcareous grassland which have been affected by agricultural intensification or neglect.
- 4.1.4 Promote restoration to species-rich grassland of areas linking existing habitats.

- 4.1.5 Manage herb-rich mesotrophic grassland by appropriate mowing and/or grazing regimes.
- 4.1.6 Manage ash-maple woodland in ways which will maintain and promote both structural and botanical diversity with the requirements of the important woodland species being fully considered. Restore areas of coniferised ancient woodland to the native ash-maple type.

4.2 To manage the wider countryside in a more extensive manner and extend the areas of semi-natural vegetation

Rationale

Virtually the whole of lowland Britain is an intensively farmed landscape within which lies a fragmented mosaic of semi-natural habitats. Within even the most intensively managed farm there are refuges for wildlife. In the Mendips these may be the hedgerows in the east, the dry stone walls in the west, roadside verges or isolated rocky outcrops in otherwise improved grassland. Without such features the total area available for wildlife would be reduced significantly. If the intensity of farm management can be reduced such features can be conserved and even created. This will result in more stable and sustainable wildlife populations.

Key elements

- 4.2.1 Maintain all remaining hedgerows in a manner consistent with their current or potential wildlife value. It is particularly important to retain ancient hedgerows and veteran hedgerow trees.
- 4.2.2 Prevent further losses of hedgerows and encourage the planting of new hedges using the native species found locally.
- 4.2.3 Retain and maintain dry stone walls as habitat features.
- 4.2.4 Encourage the appropriate management and creation of other features of value to wildlife, including ponds, grassland, small copses and farm woodland using native species.
- 4.2.5 Reduce the overall input of agrochemicals (herbicides/pesticides/fertilizers) onto land. Reverse the trend toward agricultural intensification of grassland and conversion to arable.
- 4.2.6 Establish buffer strips of at least 10m of rough grassland, scrub or woodland along all streams and rivers.
- 4.2.7 With the assistance of the Quarry Operators and the Local Authority ensure that, as quarries are worked out, they are restored to a nature conservation afteruse. There are currently hundreds of hectares of active quarries on the Mendips which will, when redundant, have a tremendous potential to support a wide range of plant and animal species.

4.3 To maintain conditions suitable for populations of all the important species

Rationale

Rare or scarce species are often the best indicators of the condition of ecosystems. Their environmental requirements are often the most demanding and their tolerance of adverse conditions lower than most other species. By ensuring that these species are catered for by sympathetic land management it is highly likely that other species will benefit. A number of the rare or scarce species in the Mendip are at or near the limit of their current ecological range. If population decline is apparent despite beneficial management then a more general problem or change in their environment, such as global warming or gross pollution is likely.

Key elements

- 4.3.1 Incorporate the particular requirements of all relevant species in the management of semi-natural habitats.
- 4.3.2 Ensure the important features for important species in the wider countryside and built environment are protected eg; conserve old hedgerow trees for bat or owl roosts and ensure such roosting sites in buildings are created, not destroyed, by development.
- 4.3.3 Investigate species declines/extinctions in the Natural Area and promote recovery programmes in the light of expected success rate. Currently the large blue butterfly and dormouse and starved wood-sedge have ongoing programmes.

4.4 Geological objectives

- 1. Maintain the integrity of inland and coastal exposures seeking enhancement of exposures/recording of temporary sections wherever practical.
- 2. Encourage production of cave conservation plans for sensitive/vulnerable sites.
- 3. Promote the strengthening of links between geology, landscape, habitats, flora and fauna.
- 4. Encourage responsible fossil collecting; we should be consulted on any excavations concerning fossiliferous cave deposits and other *integrity*-type sites.

4.5 To establish a framework of adequate legislation, liaison, influence, information and understanding through which objectives 4.1, 4.2, 4.3 and 4.4 can be achieved

Rationale

Objectives 1 - 3 identify ways in which the key wildlife and geological features of the Natural Area can be maintained and enhanced to retain the special nature of the Mendips. However, these objectives can only be achieved if they can be put into action within a cohesive framework. The future health of the Mendips wildlife depends on promoting forms of stewardship which embrace conservation objectives.

European and British legislation can be used to protect internationally and nationally important habitats and species in the Natural Area, in co-operation with landowners and other interested parties. Management of habitats in the Natural Area is determined to some extent by legislation. Management agreements between English Nature and landowners can ensure that SSSIs are managed primarily for nature conservation. However, this only applies to fragmented 'special' areas and excludes sites within the wider countryside.

Agricultural incentives are becoming increasingly directed towards environmentally-friendly farming practices. The introduction of the Agri-Environment Regulations under EC legislation offers a range of grant-aided schemes so that farmers can enhance the wildlife interest of their land. In addition, the Countryside Commission also offers financial assistance to landowners who manage their land sensitively for nature conservation and other interests.

Liaison between individuals and organisations who play an active role in the Mendips should also be encouraged so that they are aware of the significance of future management on the key features of the Natural Area.

Information about the Natural Area and its special wildlife and geological interest could be promoted through education and managed access. Leaflets on the key characteristics of the area could be produced and distributed at the most frequently used visitor spots. The Natural Area could also be promoted in local schools where it could be included within National Curriculum studies on science, environment, local history, geography and geology.

Key elements

- 4.5.1 Support legislation and schemes that can benefit nature conservation, eg SSSI designation as appropriate, and the EC Habitats and Species Directive.
- 4.5.2 Promote co-operation over land management and conservation issues through liaison.

In particular aim to ensure all managers of SSSIs and County Wildlife Sites are fully aware of their significance and the optimal way to manage them for wildlife.

- 4.5.3 Promote, inform and ensure effective use of appropriate land management schemes and programmes.

Annex 1 – Important and key features in the Mendips Natural Area

Key:	Rare	=	included on the relevant Red Data Book list for the UK
	Protected	=	included on the relevant Schedules of the Wildlife & Countryside Act and afforded special protection as a consequence
		Schedule 1	birds
		Schedule 5	other animals
		Schedule 5*	other animals protected against sale only
		Schedule 8	plants
European:		=	included on one of the Annexes to the European Community Directive on Conservation of Habitats & Species 1992
		Annex I	Habitats
		Annex II	Species which require Special Areas of Conservation and are protected
		Annex IV	Species which are protected
		Annex V	Species whose sale and exploitation are controlled
			or included on Annex 4.1 of the European Community Directive on Wild Birds 1979
Biodiversity Habitat or Species		=	included on one of the lists of the UK Steering Group Report on Biodiversity Vol 2. Action Plans. 1995
		For species only:- Short list	= Action Plan already written
		Medium list	= Medium Priority for Action Plan
		Long list	= Action Plan necessary
Key feature		=	is a characteristic habitat or species particularly associated with and/or widespread in the Natural Area
NVC		=	National Vegetation Classification

Wildlife features		Nationally Important and Protected	Regional and/or County Importance	European Habitat	Biodiversity Habitat Key Feature in Natural Area	
Wildlife Features Habitat	NVC) Those sites notified as SSSIs	*		*	*
Calcareous Grassland	CG1		*	*	*	*
Calcareous Grassland	CG2		*	*	*	*
Mesotrophic Grassland	MG5		*	*	*	*
Ash-Maple Woodland	W8		*	*	*	*
Heathland	H8		*	*	*	*
Caves and mines for bats			*	*	*	*

	Principle Habitat(s)	Rare UK	Protected UK	European Species	UK Biodiversity Species	Key Feature in Natural Area
Wildlife features species						
Mammals						
Dormouse	Woodland Hedgerows Scrub		Sch 5	IVa	Short	*
Greater horseshoe bat	Buildings Caves/mines	*	Sch 5	IIa and IVa	Short	*
Lesser horseshoe bat	Buildings Caves/mines	*	Sch 5		Middle	*
Pipistrelle bat	Buildings		Sch 5	IVa	Short	
Serotine bat	Buildings		Sch 5			
Brown long-eared bat	Buildings		Sch 5			
Bechsteins bat	Woodlands Caves	*	Sch 5	IIa and IVa	Middle	
Noctule bat			Sch 5			
Brown hare	Grassland Woodland				Short	
Otter	Rivers/streams	*	Sch 5	IIa and IVa	Short	
Roe deer	Woodland		Deer Act			
Fallow deer	Woodland		Deer Act			
Common shrew	Many		Sch 5			
Pygmy shrew	Many		Sch 5			
Birds						
Skylark	Arable grassland				Short	
Grey partridge	Arable grassland	*			Short	
Song thrush	Gardens farmland				Short	
Nightjar	Heaths/conifer forests	*	Sch 1		Short	
Linnet	Heaths				Medium	
Spotted flycatcher	Woodland				Medium	
Tree Sparrow	Woodland Hedges				Medium	

	Principle Habitat(s)	Rare UK	Protected UK	European Species	UK Biodiversity Species	Key Feature in Natural Area
Peregrine Falcon	Cliffs Quarries	*	Sch 1			
Adder	Many		Sch 5			
White-clawed crayfish	Rivers Streams	*	Sch 5	Ila	Short	
Large blue butterfly	Grassland	*	Sch 5	IVa	Short	
Pearl bordered fritillary		*	Sch 5*			
Great crested newt	Disused quarries	*	Sch 5	Ila and IVa	Short	
Plants						
Starved wood-sedge		*	Sch 8			
Cheddar pink		*	Sch 8			
White rock-rose		*				
Goldilocks aster		*				
Little robin		*				
<i>Sorbus anglica</i>		*				
<i>Sorbus porrigentiformis</i>		*				
<i>Sorbus eminens</i>		*				
Honewort		*				

Annex 2 - Geology of the Mendips

General geological character

The Mendip Hills are a series of rolling ridges (periclinal) which form a topographic high in north Somerset attaining a maximum height of 325m AOD. The Natural Area includes the Carboniferous inliers at Brean Down and Uphill. The oldest rocks exposed in the area crop out in the eastern part of the area within the Beacon Hill Pericline. Here Silurian lavas (andesites, rhyodacites) and ashes are interbedded with sandstones and mudstones which contain fossil marine shells indicating a Wenlock age (approximately 430 million years old). The environment was probably a warm, shallow sea with volcanic islands rising above the waters. In the Mendip area Lower Devonian rocks were removed by erosion during the later stages of the Caledonian Orogeny and Silurian rocks are followed unconformably by Upper Devonian 'Old Red Sandstone'. These rocks (approximately 390 to 365 myo) include coarse quartzitic sandstones, arkosic sandstones and quartz-pebble conglomerates which were deposited in a low-lying desert which was crossed by large seasonal rivers.

There is no break in sedimentation between Devonian and Carboniferous rocks in the Natural Area although the environment changed dramatically. The Lower Carboniferous (Dinantian, approximately 360 to 330 myo) sequence begins with Lower Limestone Shales and passes up into a thick sequence of bioclastic and oolitic limestones (in ascending order these are the Black Rock Limestone and Dolomite, Burrington Oolite, Clifton Down Limestone and Hotwells Limestone [other local names exist]). These sediments represent a marine transgression indicated by the deposition of a series of muddy limestones followed by the development of widespread, shallow coral seas rich in marine invertebrates including solitary and colonial corals, crinoids, bivalves, brachiopods and occasional trilobites. By Late Carboniferous times huge deltas were gradually being built out over the shallow sea floor. These gave rise to quartzitic 'Pennant Series' sandstones and eventually to Coal Measures (sandstones, shales and interbedded coal seams) which were formerly best exposed around Radstock in the Somerset Coalfield. Coal tips around Kilmersdon and Writhlington (see 'Avon Ridges and Valleys' Natural Area) have yielded a variety of beautifully preserved plant fossils and insects. The east Mendip area of 290 million years ago can therefore be pictured as a vast swamp-like delta, thickly vegetated and hosting a variety of insects and early amphibians.

Permian-aged strata are absent from the Mendips Natural Area, any rocks deposited at that time were removed by erosion associated with the folding that formed the Mendip Hills around 280 million years ago. The Mendips mark the northern front of the strongly folded and thrust belt of the Hercynian Orogeny. The surface of the Carboniferous Limestone is often deeply dissected and infilled with Triassic-aged (approximately 220 myo) marls and marginal deposits known as the Dolomitic Conglomerate which represents alluvial valley infills. The Mendips are generally surrounded by a sequence (thickening to the south) of red mudstones termed the Mercia Mudstone Group and were deposited in a shallow hypersaline lake. Towards the end of the Triassic Period (approximately 208 million years ago) the climate became generally wetter and this led to the development of underground watercourses and caves. It was from one such cave that the fossilized bones of the gliding reptile *Kuhneosaurus* were discovered; a wide range of lizards, rhynchocephalians and dinosaurs have since been found suggesting that by the end of the Triassic Period the

Mendips were well populated with such animals. These fissure fills also contain fish remains indicating sporadic marine conditions.

The Mendips remained as islands in a warm shallow sea through the succeeding Lower Jurassic up to 165 million years ago (Bathonian times). Tectonic activity resulted in local tension and the opening of faults and joints, in which accumulated fissure deposits including land-dwelling vertebrates (such as *Oligokyphus*, one of the earliest mammals). These Jurassic rocks contain shallow-water faunas including strongly-ribbed bivalves, corals and abundant encrusting and rock-boring animals. Fossil rocky sea floors have been found preserved beneath Lower and Middle Jurassic rocks in many parts of the south-east Mendips. These rocky sea floors were reworked many times, eventually forming a widespread, planar surface (hardground). This is now best preserved beneath the Upper Inferior Oolite where it is frequently found to be covered with oyster shells and traces of rock-boring animals.

There is no evidence in the Mendips of any rocks younger than mid Jurassic age, any such strata have since been removed by erosion. This erosion probably started in Pliocene times (about 10 myo) and continued throughout much of the Quaternary when the Mendips were affected by glacial or periglacial conditions. Evidence of the (peri)glacial/interglacial conditions is gained from the preservation of Palaeolithic cave deposits containing remains of bear, wolf, cave lion, hyaena, deer, cave pika, small mammals and man. Swallow-hole and associated features probably formed at about the same time. The Natural Area includes an extensive and well-developed cave karst system which has been little disturbed by glaciation. Drainage patterns are therefore largely 'original' and cave earths contain relatively long stratigraphical records.

The Mendips (a name probably derived from the mediaeval term 'Myne-deepes') have been the scene of occasional mining and quarrying for some 2,000 years. The area has been worked commercially for lead and zinc since Roman times, and minor deposits of iron and manganese have also been exploited. The minerals occur mainly as veins/fissure fills (carbonate-hosted 'Mississippian-type' ores) predominantly in the Carboniferous Limestone and Dolomitic Conglomerate; some mineralization is of secondary origin. Excluding evaporites, three main types of (metalliferous) ore mineralization can be recognised: lead and zinc ores; iron and manganese ores; and secondary lead and copper minerals. Some minerals such as *chloroxiphite* are unique to the Mendips.

Geological/geomorphological SSSI coverage

There are 26 ((P)SSSIs in the Natural Area containing 38 GCR SILs. These represent 11 different GCR networks which indicates the considerable variety of geological interest to be found in this area. Many of the sites selected represent cave/karst features: Brimble Pit and Cross Swallet Basins, Priddy Caves and Priddy Pools, Lamb Leer and Thrupe Lane Swallet. Other cave/karst sites are associated with a Dinantian interest (Lower Carboniferous stratigraphy block - Burrington Combe, St Dunstan's Well Catchment) or occasionally with Pleistocene bone remains (Wookey Hole, Ebbor Gorge and the spectacular Cheddar Complex). The Silurian volcanic interest is represented by Moons Hill Quarry and the quarries at Emborough, Cloford and Holwell contain Rhaetic-Lower Lias fissure deposits which have yielded important vertebrate remains including those of flying reptiles, fish and the earliest mammals. Quaternary sediments, or younger, related to periglacial conditions are exposed at Bleadon Hill and Brean Down - the latter is noted for the presence of a wedge of soft sediments against the SE face which contain an unusually complete archaeological

succession extending from the Devensian Glacial (22,000 years ago) through Bronze Age to Romano British times. Mineralogical interest sites in the Mendips are represented by Wurt Pit and Devil's Punchbowl, the Cheddar Complex and Shipham Zinc Orefield (the last site being subject to current revision).

Earth science (p)SSSIs in the Natural Area:

- Bleadon Hill
- Banwell Caves
- Banwell Ochre Caves
- Combe Martin Ochre Mine
- Brean Down
- Crook Peak to Shute Shelve Hill
- Brimble Pit and Cross Swallet Basins
- Burrington Coombe
- Ebbor Gorge
- Emborough Quarries
- Priddy Caves
- Priddy Pools
- Sandpit Hole and Bishops' Lot
- Vallis Vale
- St Dunstan's Well Catchment
- Thrupe Lane Swallet
- Wurt Pit and Devil's Punchbowl
- Lamb Leer
- Holwell Quarries
- Cloford Quarry
- Maesbury Railway Cutting
- Moons Hill Quarry
- Wookey Hole
- Wookey Station
- Shipham Zinc Orefield
- The Cheddar Complex
- Cooks Wood Quarry