

Cornish Killas and Granites

Natural Area Profile

1997

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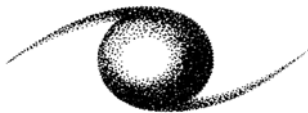
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Illustrations by S McCartney



*Environmental
Consultants
(CTNC) Ltd.*

October 1997

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Foreword

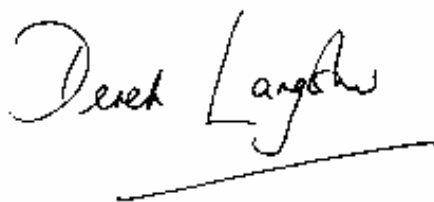
One of the key components of English Nature's *Strategy for the 1990s* has been the Natural Areas approach. We examined the local distinctiveness of each part of England, to identify their characteristic wildlife and natural features, and used this to define a comprehensive series of Natural Areas. Their 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 these documents 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 that reads "Derek Langslow". The signature is written in a cursive style and is positioned above a horizontal line that extends to the right.

Dr Derek Langslow
Chief Executive

Summary

The Natural Areas approach to nature conservation aims to focus attention on, and gain support for, the areas where action is needed to address local and (inter)national conservation priorities. The development of the concept is a key part of English Nature's strategy to promote, enable and achieve biodiversity and geological heritage conservation. A Natural Area is not a designation, but an area of countryside identified by its unique combination of physical attributes, wildlife, land use and culture. With their emphasis on the whole picture, local distinctiveness and high priorities, Natural Areas provide an improved framework for securing public support and partnership for wildlife and geological conservation.

The **Cornish Killas and Granites Natural Area** covers most of the Cornish peninsula, from Penzance in the west to Saltash in the east, and from Helston in the south to Boscastle in the north. It is largely defined by the underlying geology, which is composed mainly of slightly metamorphosed rocks (the killas) and granite. The geology is of outstanding interest and international importance in its own right, providing evidence of a series of mountain building episodes in Europe over 300 million years ago, as well as through its influence on the overlying soils and habitats. Cornwall's mineralogy is of international importance, with 39 mineral type localities and 6 species unique to the county.

A great diversity of habitats and species are present within the Natural Area. Approximately 75% of the land is given over to agriculture, predominantly dairying and beef production, while the remaining 25% is split between internationally important habitats such as heathland, ancient woodland and parkland, and habitats of national significance such as herb-rich unimproved grassland and wetlands. Cornish hedges and derelict mine sites are recognised more and more widely as important habitats for wildlife, as well as having great cultural, archaeological and landscape value. All these habitats between them support over 400 species of national or international conservation concern in the Natural Area, including five species which are endemic to the UK and which have major strongholds in the Natural Area. These are the lichen *Graphina pauciloculata*, the liverwort *Cephaloziella nicholsonii*, and the flowering plants Vigur's eyebright, western ramping-fumitory and purple ramping-fumitory.

The habitats and species present are greatly influenced by past and present land use, which has been predominantly mixed farming, and the character of the physical and climatic environment. However changes in land management over recent decades have adversely affected the nature conservation interest of the Natural Area. This profile aims:

- to describe and evaluate the key nature conservation features of the Cornish Killas and Granites;
- to outline the main issues affecting them;
- highlight the need for action; and
- to propose nature conservation objectives for discussion.

The production of this Natural Area Profile is the first step towards securing local agreement on what the priorities for nature conservation are within the Cornish Killas and Granites Natural Area. The profile is consistent with the UK Biodiversity Action Plan, and in

particular with the UK Steering Group report on biodiversity which was submitted to Government in December 1995. The profile will, over the next few years, help with the development and implementation of the National and relevant Local Biodiversity Action Plans.

Cornish Killas and Granites Natural Area

A Vision for the Future

To many people who visit Cornwall, the Killas and Granites Natural Area is a gateway to the coast. To those who know it better it is a unique, special and working Cornish landscape of contrasting and complimentary characteristics which include:

- Ancient and modern history etched together in the landscape
- Natural beauty and the active quarries of the working landscape
- Distant views over windswept, rolling hills and intimate winding sunken lanes and wooded river valleys
- Small fields defined by Cornish Hedges and the bright purple and yellow flowers of the western heath of ancient extensive grazings
- Ancient oak woods, primeval willow carr and the bare ground, spoil heaps and engine houses of an industrial past
- Valley mires and wet meadows and ripening corn fields
- The infrastructure of a rural economy supporting a dispersed population and increasing pressures for urbanisation and tourist facilities

This diversity blends to create a unity that is unmistakably Cornish but if we continue to lose these features at the current rate, become complacent or forget their value what will be left in the future to distinguish this Natural Area from other lowland areas of England? We all have our own ideas and ways of contributing, but as we go into the Millennium can our shared vision for the future of the Cornish Killas and Granites include the following?

Guiding Principles As a minimum we want the Natural Area to be at least as rich in wildlife and geological features as it is now but we also want to reverse negative trends and build on positive ones to produce a richer landscape.

Agriculture Farmers and agricultural policy makers will take a broader view of the purpose of farming. Farmers will derive satisfaction from producing barn owls as well as beef, marsh fritillaries as well as milk and primroses as well as potatoes. The conservation needs of the Natural Area will influence agricultural policy. Its rural economy will be developed, not just by stimulating greater food production but more through an overall approach that fundamentally maintains and enhances the environment. Farming systems will create more Cornish/environment-friendly, and therefore quality, branded products. As part of this approach neglected lowland habitats will be brought into sustainable management with wildlife benefits.

Forestry Woodland managers and forestry practitioners will fully embrace the concepts of, and detailed advice on, managing and creating natural-type woodland as part of a sustainable forestry strategy.

Development In addressing their effects on the environment, developers, planners and industry will seek to incorporate projects into the character of the Natural Area rather than cut across it. Extractive industries will seek to re-create lost semi-natural habitats and maintain geological features as a top priority in restoration schemes.

Water Water resources will be wisely used and the highest standards of water quality pursued so that river systems are near pristine and wetlands flourish.

People Future generations should continue to have access to the countryside, whilst respecting its primary role in farming and other land uses, to enjoy, appreciate and learn about biodiversity and geology. Recreation will take as its starting point conservation of the resource people wish to enjoy. Land managers, the general public, government and other decision makers will be better informed about the importance and role of nature conservation in the Natural Area. They will better understand the issues affecting its characteristic wildlife and features of interest, what action is needed, how it can be resourced and how they can contribute. There will be greater rural employment linked to conservation management.

Learning Research will be carried out and disseminated to further understanding and we will apply best practice in habitat, species and geology management to achieve the best possible results.

Biodiversity and geological heritage gains such as the following will be realised:

Mixed Farming will expand again and adopt more wildlife friendly practices. Pockets of unimproved habitat will be retained, linked and positively managed. Less silage and more hay production with late cuts will mean corn crakes might breed again. A return to spring sown cereals like barley will see large splashes of arable wildflowers and provide winter seed so that curlew and corn bunting can thrive again. Hedges will be retained and allowed to grow with conservation headlands (field margins) a standard practice to provide food and space for wild plants and animals like the grey partridge. Grazed permanent pastures and judicious use of targeted pesticides will allow grasslands to buzz with insect life, including declining species like the hornet robber fly. Food webs that include rare horseshoe bats, and until recently, near the coast, the Cornish chough, will be rebuilt where they have been lost.

Cornish Hedges will not suffer any more significant losses. Local distinctiveness will be maintained and sensitive cutting regimes will be adopted as standard. With the promotion of wide verges next to roads or untreated strips on farmland and a flourishing flora including berry-bearing shrubs, the dependent bats, birds and rare plants like the ramping fumitories will be much more common.

Heaths will be larger and more numerous with more flowering wildflowers, like heathers, and less scrub. They will be grazed in summer to create diversity, allowing rare plants like Vigur's eyebright and other wildlife swamped by coarse growth to thrive. Burning, if necessary, will be carried out over small areas on long rotations and as part of a sustainable grazing regime. Areas of bare ground will be encouraged for the important role they perform for much wildlife, including nesting nightjars whose distinctive nocturnal churr will once more be common.

Woodlands will be greater in extent and more linked. Long-established wet willow and alder woods will come to be better respected, like the western oak woods, for their own special

biodiversity. Many more trees will be allowed to develop to maturity and beyond, to leave standing deadwood with lots of holes - a prime habitat in itself for many small species and the bats and woodpeckers that feed on them. Restored coppices with their flushes of bluebells and well-managed glades and rides will be brightened up again by pearl bordered and heath fritillary butterflies and orange upperwing moths. We will lose no more significant areas of irreplaceable ancient semi-natural woodland. Ancient woods previously replanted with conifers will be restored and new areas planted with native tree and shrub mixes characteristic of the Natural Area and derived from local seed sources. Diversity within woods will be encouraged through varying age structures, allowing more natural regeneration, developing fuller shrub layers (of benefit to dormice) and providing open ground with a long woodland edge. However, invasive exotics like rhododendron and laurel will be removed. Parklands with trees supporting rich lichen floras will be secured for the future through retention of veteran trees and new planting for the next generation of veterans.

Mining and Quarrying Land (including **Derelict Land**) will have its conservation and cultural importance fully recognised and incorporated into decisions over its (after)uses. Geological exposures and rich mineral sites will be retained. The many special and unusual plants and animals associated with derelict land, including lower plants like the western rustwort and copper-tolerant liverworts, and the scarce blue-tailed damselfly, will have their needs met. We will learn from how species adapt to utilise derelict land.

Meadows and Pastures will once again be centres of biodiversity with both flower-rich hay meadows and pastures with ant hills. Partly improved fields will be restored to their former glory as part of farming systems. Wildflowers for so long restricted to hedges will once again flower and set seed in many fields.

Rivers and Streams will follow natural courses and be connected to their floodplain without risks to people. With high water quality, healthy flows and riverside habitats they will teem with fish life. Otters will reach carrying capacity and water voles will expand their range.

Marshes, Mires and Wet Meadows and their associated **Pools** and **Ponds** will be kept wet, and restored where drainage has taken place. This will support their varied wildlife, such as dragonflies, which need a high water table. Grazing of neglected areas will ensure that wildlife dependent on open vegetation is supported. We may rediscover hidden jewels like bog orchids, marsh clubmoss and coral necklace. Winter flooded meadows will be restored to river valleys so that once again “drumming” snipe might breed. Reedbeds will be managed to maximise their value to birds like Cetti’s, aquatic and reed warblers. New reedbeds will be created as part of constructed wetlands with multi-functions including flood defence, water quality and biodiversity.

Without the support of land managers and the general public this vision will not be fulfilled. Nature conservation must be balanced with other land uses such as development and recreation. Agriculture, quarrying and tourism will continue to be dominant forces and must be profitable whilst recognising the considerable benefits of a healthy environment. Decisions will be taken on the basis of long term value rather than short term expediency.

If all, or even some, of this is achieved the survival of many species such as skylarks and dormice, as well as countless other less familiar ones, will be ensured. Lost species will return; perhaps the chough will once again breed on the Cornish coast as part of a low intensity, diverse, farmed coastal strip. The distinctive landscape and character of the Cornish

Killas and Granites will be retained and enhanced for future generations to live and work in.
Our environment will sustain us and continue to enrich the quality of our lives.

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1 The Natural Areas concept

The development of the Natural Areas concept is a key part of English Nature's strategy to help conserve nature in England. The Natural Areas are considered to provide an improved framework for integrating planning and management of the countryside, securing public support for wildlife and geological conservation, setting objectives for nature conservation and greatly improving English Nature's ability to work together with others to deliver effective action. Natural Areas take account of both local needs and national priorities.

The land area of England and the seas around it have been divided into some 126 Natural Areas and Maritime Natural Areas, of which the Cornish Killas and Granites is one. A Natural Area is not a designation, but an area of 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 in a sensible ecological context. The concept relies upon wide participation and enables all those involved to "Think globally, act locally".

Through Natural Areas, English Nature aims not only to help set the context for special sites such as nature reserves and Sites of Special Scientific Interest, but just as importantly to promote action to conserve wildlife and geological features throughout the countryside. It is hoped that people will be stimulated to look after plants and animals wherever they may be, and whether they are rare or still commonplace.

1.1 The role of the Profile

This profile sets out to describe and evaluate the wildlife and geological features of the Cornish Killas and Granites Natural Area, to identify the key issues affecting them and the need for action. Important habitats, species and physical features within the Natural Area are identified and described, and objectives set for their conservation.

The profile is written for all those with an interest in and influence on nature conservation within the area identified as the Cornish Killas and Granites. It is hoped that it will serve to draw public organisations, conservation bodies and local people closer together, towards the achievement of shared objectives that address the top priorities for conservation within the Natural Area.

The document is consistent with recent thinking on the conservation of biodiversity in the UK. In particular, it draws on *Biodiversity: The UK Steering Group Report*, published in December 1995, which develops several of the prime objectives set out in *Biodiversity: The UK Action Plan* (1994). The Plan commits the Government to the objectives of the Convention on Biological Diversity, signed by the Prime Minister at the Earth Summit in Rio de Janeiro in June 1992. *The UK Steering Group Report* includes lists of species of conservation concern in the UK, as well as costed action plans for some 14 key habitats and 116 key species. It also covers the production of Local Biodiversity Action Plans, seen as the means of implementing the UK plans at the local level.

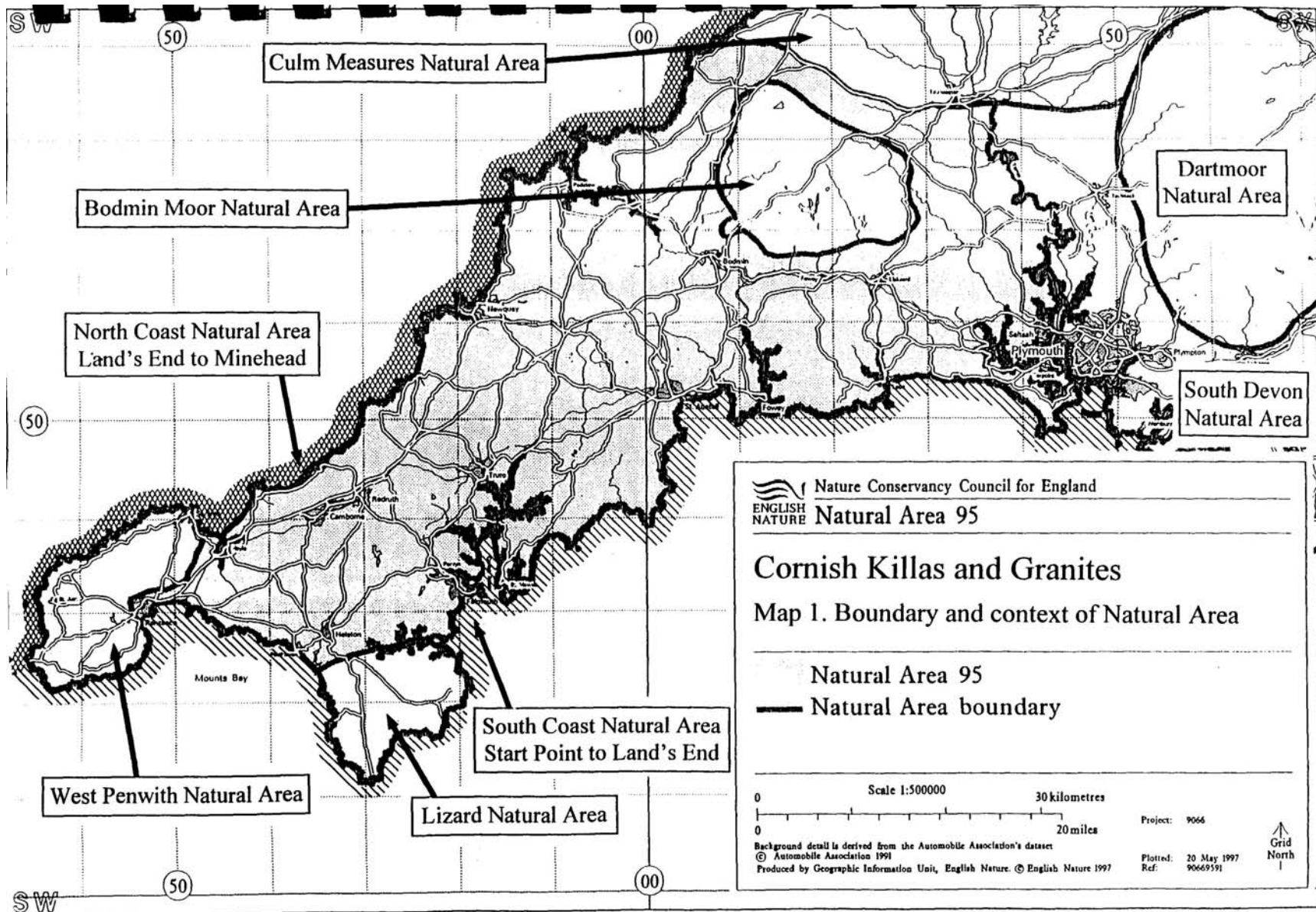
The profile has been written in a style and format that should allow it to be developed easily into a nature conservation strategy as part of the Local Biodiversity Action Plan process for the whole Natural Area or for Districts or Character Areas within it. The development of these can be achieved through the addition of policies, targets and action points.

1.2 The Natural Area boundary

In Cornwall, Natural Areas are largely defined by distinct geological zones and the strong maritime influence in the county. Natural Areas such as West Penwith, The Lizard and Bodmin Moor have a unique character closely linked to their geology. In the north-east of the county the geology of the Culm Measures produces a landscape and wildlife interest with affinity to North Devon.

The Cornish Killas and Granites Natural Area covers most of the Cornish peninsula, lying between the Natural Areas of the Culm Measures, West Penwith and The Lizard, and completely surrounding Bodmin Moor (*Map 1*). The north and south coasts and a narrow strip of coastal habitats with their own special character form the Maritime Natural Areas of Start Point to Land's End and Land's End to Minehead. This leaves a large part of the Cornish peninsula composed of the typical slates and shales known locally as killas and an array of smaller granite outcrops (compared with Penwith and Bodmin) - the Cornish Killas and Granites Natural Area. Whilst it is more diverse than other Natural Areas in the county it supports the underlying unifying features described in this Profile. The relationship of the Natural Areas is shown schematically in *Map 1*.

The Maritime Natural Area Profiles describe the importance of, and objectives for, marine and coastal features including terrestrial maritime habitats heavily influenced by the sea, eg saltmarsh, sand dunes and sea cliffs. There are close links between the wildlife and geological features of all these Natural Areas, and consequently this Profile should be considered and used within the context of all of the Natural Area Profiles.



2 Cornish Killas and Granites Natural Area

2.1 An introduction

The rolling hills and deep valleys of the Cornish Killas and Granites Natural Area are never more than 15 miles from the sea. The prevailing winds are westerly, helping to form the character of the exposed north coast, which consists of high, rugged cliffs and occasional sand dune systems. The south coast is more sheltered, with many wooded valleys and rias and a softer landscape. Inland, the countryside is characterised by rolling farmland intersected by many steep-sided valleys, heaths and valley mires. Cornish hedges, derelict mine workings and occasional granite outcrops are distinctive features in the landscape. The landscape importance of large parts of the Natural Area is recognised in Area of Outstanding Natural Beauty designations. Settlements are characteristically small and dispersed, linked by a complex web of ancient hedge-lined tracks and lanes, and everywhere there are relics of times past, in wayside crosses, standing stones and ancient burial sites.

2.2 Influences on the Nature Conservation Interest of the Natural Area

The character of the Natural Area is heavily influenced by its underlying geology, geographical position, climatic history, geomorphological processes and human activities.

The geology is of conservation interest in itself as it shows distinct evidence of past tectonic activity and mineralisation, but it has also influenced soil formation and thereby the habitats present and the species dependent on those habitats, many of which are also of conservation interest. The impervious nature of the underlying rocks gives rise to a high density of streams and rivers, and the acidity of the rocks affects the pH levels of the headwaters. The Natural Area's position in the most south-westerly peninsula of mainland Britain endows it with a mild climate, and its proximity to the sea affects the habitats and species present through high levels of rainfall, exposure to salt spray and westerly winds, and through reducing the annual temperature range. Compared to the rest of southern England, it is generally warmer in winter and cooler in summer. The soils and geomorphology of the Natural Area have been influenced by past climates, particularly during and immediately after the last Ice Age, when the rias of the south coast were formed. Climatic change has also affected historical species dispersal and distribution in the Natural Area. The flat horizons formed by prehistoric marine erosion processes contrast with the intimate nature of the landscape when viewed close to. Geomorphological processes such as erosion or deposition of silt in rivers, longshore drift and the deposition of wind-blown sand to form dunes both destroys and creates habitats, thereby influencing the distribution of species dependent on those habitats.

All of the above are natural processes. Perhaps the greatest influence on a local level, however, is that of human activities. Human history pervades and defines the landscape. We have exploited the natural resources of the land since our arrival in Cornwall approximately 5,000 years ago. The natural climax vegetation over much of the peninsula at that time would have been high forest, of which very little now remains. It was cleared slowly at first, then more rapidly as people discovered ores and were able to fashion tools out of metal. With the development of agriculture, deforestation accelerated still further and the vegetation communities present were altered to a great extent, with more species typical of open habitats occurring. Field boundaries were constructed out of local materials such as stone and earth, providing a new habitat and latterly becoming an important factor in the "Cornishness" of the landscape. Remaining woodlands were often managed as a timber crop by coppicing to

produce poles for furniture and building. Land management practices have changed considerably this century, especially since the Second World War; agriculture has intensified through mechanisation and specialisation whilst management of some semi-natural habitats such as broadleaved woodlands has ceased in places. This too has influenced the species present.

The development of tools and the discovery of deposits of metal ores such as tin and copper led to widespread extraction of the ores, especially by the process of "tin-streaming". The processing of the ores created areas of metal-contaminated land where nothing would grow for years. The metal mining industries grew with the Napoleonic Wars and the Industrial Revolution, but declined with the arrival of cheaper imports or as deposits became uneconomic to pursue. China clay extraction, however, has grown in that time and still has a large influence on the local environment.

The interdependence of the physical environment, habitats and species of the Natural Area on natural environmental processes and the Cornish culture is evident. It is important therefore to take a holistic approach to the conservation of the features present, and to involve everyone with an interest in the Natural Area in the setting and achieving of objectives for future management. It is also important to target the limited resources available at conserving features which, through being conserved themselves, would help greatly in the conservation of others.

In the following pages the Cornish Killas and Granites Natural Area is described in terms of its natural features and the factors that have influenced the formation of these features. Those features which are described as "key" are considered to be either rare and declining, have a stronghold in the Natural Area, or are typical of and important in people's perceptions of the Natural Area and contribute substantially to its character.

Conservation issues and other factors affecting the key features are identified and listed in each section. Because of the interdependence firstly of the habitats present on the physical landforms and geology, and secondly of the species on the habitats present, many of the issues will apply to two or more sections. A number of objectives are proposed at the end of each section which will form the basis of efforts to achieve our Vision for the Future.

3 Geology and Landforms

The Natural Area takes its name from the underlying geology. This records some of the most interesting chapters of England's geological history - a time over 300 million years ago when continents were colliding, producing great upwellings of molten rock from the Earth's depths; and a time around 20,000 years ago when Cornwall was a windswept frozen waste at the edge of great ice sheets which covered most of Britain.

These monumental events have created a series of granite masses surrounded by slates and sandstones known as the "killas" (an old mining term). The granites form a spine to the South West Peninsula and the three largest granite areas also form Natural Areas themselves: West Penwith, Bodmin Moor and Dartmoor. The rocks derive largely from the Devonian and Carboniferous periods of geological history (406-280 million years ago (Ma)) (Map 2) and provide evidence for the sequence of events which make up the Variscan Orogeny (a phase of

mountain-building which took place during the Carboniferous). The granites were formed around 290-270Ma.

The strongly metamorphosed rocks immediately surrounding the granite bosses contain many minerals, some of which are found nowhere else in the world. Veins of metal-bearing ores, the working of which for so long provided the basis of the Cornish economy, are also found in these areas. The remains of the old mines now contribute greatly to the “Cornishness” of the landscape.

Limited outcrops of younger rocks, such as gravels and clays of the Tertiary period (65-2 million years ago) and Quaternary head deposits (within the last 2 million years), are also found within the Natural Area.

From a distance, the countryside of the Cornish Killas and Granites appears generally flat, punctuated by occasional hills. This flatness is a result of marine erosion which occurred when the area was inundated by the sea, largely during the later Tertiary period. Close up, however, the Cornish landscape is closed and intimate, with many small wooded valleys crossing the “plain” as the streams and rivers wend their way towards the sea.

Over the last two million years, the area has at intervals been subjected to Arctic-like conditions during successive Ice Ages. Raised sea levels following the last Ice Age in particular led to the formation of the rias, or drowned river valleys, of the South Coast.

The key geological and landform features of the Cornish Killas and Granites are described below. Many of these features are of outstanding significance: 28 sites are designated or proposed SSSIs (Table 1) which comprise 35 sites in the Geological Conservation Review. A further 26 sites of significance have been designated Regionally Important Geological/geomorphological Sites (RIGS) (see Table 1).

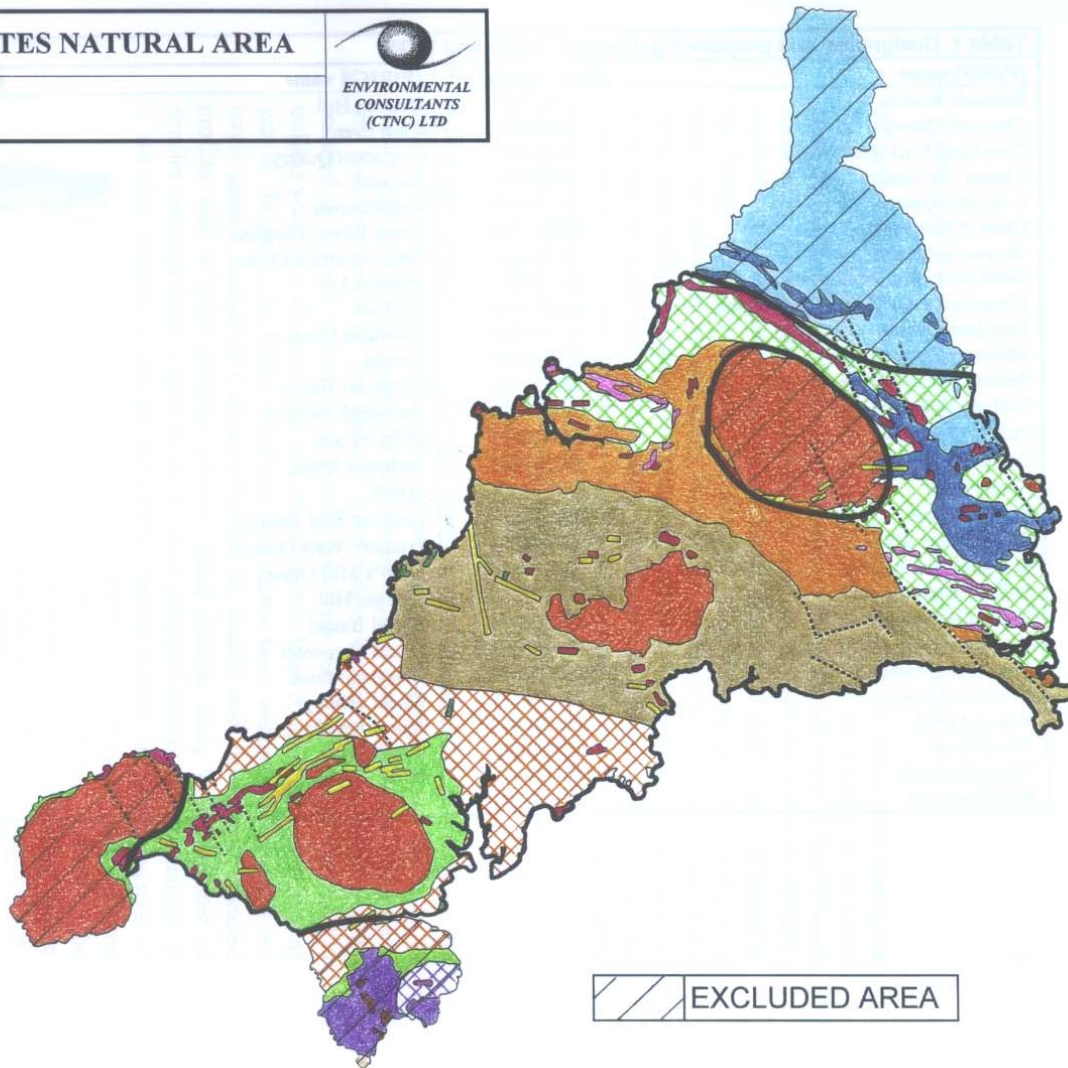
CORNISH KILLAS AND GRANITES NATURAL AREA



Map 2. Geological context

KEY TO GEOLOGICAL MAPS

- Tertiary
- Upper Carboniferous
- Lower Carboniferous
- Upper Devonian
- Upper Devonian (Mylor Slate Formation)
- Middle & Upper Devonian (Gramscatho Group)
- Middle & Upper Devonian
- Lower Devonian
- Granite
- Granite porphyry dyke (Elvan)
- Lamprophyre dyke
- Dolerite
- Volcanic tuff and lava
- Hornblende schist
- Gabbro
- Serpentinite
- Granitic gneiss
- Mica Schist & Gneiss
- Fault



EXCLUDED AREA

Table 1. Designated and proposed geological SSSIs and RIGS			
(P)SSSI name	Grid reference	(P)RIGS name	Grid reference
Belowda Beacon	SW972627	Beacon Hill	SW783337
Cameron Quarry	SW704507	Carn Brea	SW684407
Carn Grey Rock and Quarry	SX034551	Chywoon Quarry	SW748348
Clicker Tor Quarry	SX285614	Duporth	SX036512
Crocadon Quarry	SX396659	Goonbarrow	SX007583
Great Wheal Fortune	SW627289	Great Wheal Fortune	SW626288
Greystone Quarry	SX366805	Harrowbarrow Mine	SX401701
Gwithian to Mexico Towans	SW570395	Helman Tor	SX062615
Hingston Down Quarry and Consols	SX410718	Kit Hill	SX376713
Luxulyan Quarry	SX055590	Landlake Quarries	SX328823
Mulberry Downs Quarry	SX019658	Lemail	SX022731
Penberthy Croft Mine	SX554324	Luxulyan Valley	SX056571
Penhale Dunes	SW770570	Nansough Quarry	SW875510
Polyne Quarry	SX225531	Oldwit Lane	SX318819
Polyphant	SX260825	Redmoor Mine	SX356711
Roche Rock	SW991596	Trelill	SX039777
Rosenun Lane	SX249617	Tremore East Quarry	SX011648
South Terras Mine	SW933522	Tremore West Quarry	SX010649
St Agnes Beacon Pits	SW705510	Tubb's Mill Quarry	SW962432
St Erth Sand Pits	SW557351	Vinegar Hill	SX397642
St Mewan Beacon	SW986534	Wheal Basset	SW690398
Tregargus Quarries	SW949541	Wheal Carpenter	SW584353
Trelavour Downs	SW960575	Wheal Gorland	SW731428
Viverdon Quarry	SX374675	Wheal Johnny	SW627412
Wheal Alfred	SW580370	Wheal Remfy	SW924575
Wheal Boys	SX005800	Wheal Uny	SW695410
Wheal Gorland	SW734429		
Wheal Martyn	SX002555		

The key geological and landform features of the Natural Area are:

- **Structural geology.** Rocks laid down as sediments on the ocean floor during the Devonian period were buckled, squeezed and lifted by the closure of an ocean strait during the Carboniferous as continents to the north and south drifted towards each other. The closure of the strait is associated with the Variscan orogeny, evidence of which can be seen in coastal exposures and quarry faces throughout the Natural Area, for example at Polyphant SSSI. Spectacular folds in the rock layers are visible in the sea cliffs. In the later stages of the orogeny, some of the rocks were folded and squeezed to such an extent that they sheared along lines of weakness, or faults, and slid over each other in masses called "nappes", rather like slates on a roof. These are clearly visible at Greystone Quarry SSSI. The orogeny was accompanied by volcanic activity, when molten rock was injected into the sediments of the sea floor, resulting in layers of igneous "greenstones". These can be seen on the coast at Trevone Bay SSSI.
- **Killas and granite.** The enormous pressures and temperatures generated by the deformation of the ocean floor during the Variscan Orogeny caused the rocks to metamorphose into the slates and sandstones of the present-day killas. These form the low-lying parts of the Natural Area today. Underground volcanic activity resulted in several injections of molten rock into the killas around 300 to 270 million years ago which cooled and crystallised to form roughly circular domes of granite. In parts, the softer overlying rocks have been weathered away, and the larger granite masses of Carnmenellis and St. Austell now have gently rounded profiles with a radial drainage pattern. These granites along with a number of smaller outcrops form a spine to the Cornish peninsula known as a "batholith". It is not clear whether or not the separately intruded granites are linked together at depth. The intense heat of the upwelling magma baked the surrounding killas, resulting in an encircling belt, or aureole, of metamorphic (altered) rock surrounding each granite boss. The width of the aureole is determined to some extent by the angle at which the granite dips beneath the surrounding, or country, rock, and the presence of metamorphosed slates and sandstones some distance away from any granite outcrop indicates granite at a shallow depth underground.
- **Minerals.** Cornwall is world-renowned for its mineralogical interest. Its mineral suite comprises 450 species, 6 of which are unique to the county. 39 of the 400 or so mineral locations in the county are type localities (the first place the mineral was discovered). Examples of type localities in the Cornish Killas and Granites Natural Area are Hingston Downs (Arthurite), Wheal Carpenter, Gwinear (Cornubite) and Wheal Basset, Illogan (Bassetite).

The Natural Area has had a long history of minerals exploitation, which has helped to shape its cultural and landscape heritage. Many of the veins of metal-bearing minerals (ores) were formed as a result of the intrusions of granite into the overlying rocks and are generally found in the metamorphic aureoles surrounding the granite bosses. Some ores are magmatic. Hot water was pushed into fractures in the granites and killas, dissolving elements which included copper, tin, lead and zinc. When the solutions cooled, they crystallised in the fissures as veins of metal ores such as cassiterite (tin) and chalcopyrite

(copper). (The word “lode” frequently applied to these metal ores is derived from the verb “to lead”. A few ores, eg magnetite and pyrrhotite have magnetic properties which could be used to guide the miners.) The working of these ores has resulted in the abundance in some parts of Cornwall of derelict mine sites and spoil where vegetation is slow to develop. The familiar shape of the Cornish engine-houses is a characteristic feature in the landscape of the Natural Area.

- **China clay.** The china clay deposits in the Natural Area are a result of kaolinisation of the granite. One of the major constituents of granite is feldspar, which can be attacked by hot carbonated water in the rocks, breaking down its crystalline structure and converting it into the common clay mineral kaolinite, from which the china clay, or kaolin, is derived. The largest deposits of china clay are found in the St. Austell area, and are thought to be some of the best deposits in the world in terms of their quality. The name “china clay” comes from its use in the manufacture of porcelain. Its diverse uses nowadays include the manufacture of paper. The industry now involves fewer, larger working quarries. It generates large quantities of waste relative to product.
- **Tertiary deposits.** After the continental collision which closed the ocean strait, the area became part of a great desert continent during the Permian and Triassic periods (280-195 million years ago). No Cornish rocks remain from this time until the Tertiary period. A few isolated patches of gravels and clays have been dated from the Tertiary, such as those found at St. Agnes Beacon Pits SSSI which date from the Oligocene epoch (36.5-23 million years ago).
- **Head deposits.** During the Ice Ages, Cornwall escaped the ravages of the great ice sheets, and instead had a climate like that of the tundra regions of the world today. Permafrost (“permanently” frozen) soils developed, the top layers of which would flow downslope with partial summer melting, to form thick deposits of head found at the bottom of slopes throughout the Natural Area. The best exposures are found on the coast.
- **Rias.** Towards the end of the last Ice Age, as the climate ameliorated, the great ice sheets began to retreat. As their weight lifted from the land, the land rose, causing lowered base levels for the rivers, which cut down quickly into the bedrock, forming steep-sided valleys. With further warming the polar ice sheets melted, causing sea levels to rise and flooding the newly formed river valleys to form the present-day rias of the south coast.
- **Fossils.** There are lots of fossils scattered through the Devonian and Carboniferous rocks: vertebrates (eg fish), arthropods (eg trilobites), brachiopods (lampshells), molluscs (especially cephalopods useful for dating), echinoderms, corals and microfossils. They were deposited mainly when the Cornish land mass was south of the equator!

The sands and clays found at St. Erth date from the late Pliocene epoch, approximately 2 million years ago, and are thought to be the only deposits of this age in Britain. Fossils of marine molluscs and foraminifera (single-celled organisms with a calcareous exoskeleton) both date the sediments and indicate that the climate prevailing at that time was sub-tropical or Mediterranean.

- **Soils.** As the extreme south-west of Britain was not glaciated during the last Ice Age, the soils lie largely over the parent rocks from which they were formed. In the Cornish Killas and Granites Natural Area the soils are predominantly acidic.
- **Pollen stratigraphy.** The pollen record from beneath barrows and other ancient archaeological sites is largely intact and very useful in interpreting paleoclimates and recent (*ie* within the last 10,000 years) environmental change in the area.

3.1 Geology and Landform Issues and Objectives

The geological and geomorphological features of the Natural Area, including the coastal exposures of these features, are of outstanding conservation significance. They contribute greatly to our understanding of past tectonic processes and also have a role to play in the economy, through the working of minerals and aggregates. The minerals extraction activities continue to have an influence on the conservation interest through not only managing and using the resource, but also by exposing geological formations of interest.

The major issues affecting the key geological and landform features of the Cornish Killas and Granites Natural Area and objectives proposed for their conservation are outlined in Table 2. The overall objective is to maintain, enhance and promote sustainably the geological resource, and in particular the rock exposures (both natural and man-made), mine sites and natural landforms important for understanding the origin and development of the Natural Area and its place in the South West and the UK.

Table 2. Geology and landform conservation issues and objectives	
Conservation issues	Conservation objectives
<p>Loss or damage to geological or landform features</p> <ul style="list-style-type: none"> ● Lack of information/awareness of importance of physical features <ul style="list-style-type: none"> - Lack of information about site specific management requirements - Overcollection of minerals and fossils - Damage from visitor pressure - Opportunities for increasing public awareness not effectively taken up ● Development <ul style="list-style-type: none"> - Landfill sites created in disused quarries, derelict mine sites and river valleys - Road construction schemes - Housing and commercial development - Flood defence schemes (altering river profiles) - Mineshaft capping ● Extraction of raw materials <ul style="list-style-type: none"> - Utilisation of mine spoil for economic return - China clay extraction - Quarrying for aggregates, building materials, etc. - Unsustainable levels of extraction - Restoration of spoil heaps to inappropriate topography ● Inappropriate management of physical features <ul style="list-style-type: none"> - Landscaping of derelict mine sites - Neglect of geological exposures - Soil character affected by agricultural practices ● Site protection <ul style="list-style-type: none"> - Agree conservation sites through proposed Derelict Land Reclamation Strategy, Minerals Local Plan and the review of quarry planning permissions <p>Creation and enhancement of physical features</p> <ul style="list-style-type: none"> ● Quarrying creates new exposures ● Exposures created in road developments ● Lack of funding for enhancement projects 	<p>Prevent further loss or damage to the geological and landform resource</p> <ul style="list-style-type: none"> ● Identify and record the total geological and landform resource of the Natural Area <ul style="list-style-type: none"> - Promote research into and surveys of physical features - Identify and document all important sites within the Natural Area ● Protect important sites from loss or damage <ul style="list-style-type: none"> - Manage access if appropriate - Liaise with English Nature and RIGS group to identify further RIGS - Complete geological SSSI programme, implement Site Management Briefs and monitor SSSIs - Liaise with planning authorities over the siting of future developments, particularly landfill sites, and landscaping schemes ● Promote appropriate management of physical features <ul style="list-style-type: none"> - Identify features which would benefit from active management, eg vegetated rock faces that need clearing - Identify sources of funding for management and enhancement, eg Landfill Tax - Liaise with highways authority to retain roadside rock exposures - Liaise with quarrying companies to agree conservation faces in working quarries - Encourage the use of safe alternatives to the capping of mineshafts ● Raise the profile of the Natural Area's geological importance <ul style="list-style-type: none"> - Promote the production and distribution of targeted education material - Improve access and on-site interpretation on geological sites where feasible - Provide guided walks and talks - Promote the geological resource through green tourism, eg geological trails, and by strengthening links between geology, scenery, habitats, and the cultural and industrial heritage - Provide management advice to farmers and landowners

4 Habitats

Climate, soils, drainage, geology and proximity to the sea all have an influence on the habitats and species present. The mild climate and exposure to salt spray influence the species composition of the vegetation, and exposure to the prevailing south-westerlies results in stunted growth forms. The geology influences the overlying soils, which in turn influence the habitats through the preference of plants for certain levels of acidity. Soil structure and drainage, or lack of it, also influence the distribution of habitats.

The habitats present in the Natural Area have also been heavily influenced and much modified by human activity over the millennia. There is evidence of human settlement on the Cornish peninsula since Mesolithic times. Extensive woodland clearance during the Bronze Age led to the expansion of heathlands, which were subsequently used as a source of rough grazing and fuel. Agricultural activity has undergone periods of expansion, driven by the need to feed increasing populations, and contraction when large numbers of men were required by the minerals industries (particularly tin mining) and when populations crashed through disease, such as the Black Death in the 1340s.

Table 3 shows the percentage landcover of the main habitat types which occur in the Cornish Killas and Granites Natural Area. The Natural Area is characterised by rolling farmland dissected by hedgerows and steep wooded valleys, and interspersed with heaths and valley mires. Over three-quarters of the land area is devoted to agricultural production. Much of the existing semi-natural habitat is fragmented, but extensive tracts of heathland, mire and willow carr are still found, often associated with previous mineral workings. Some are of national or international importance. Cornish hedges and derelict mine workings are distinctive and defining features in the landscape.

Small fragments of unimproved grassland are present on steep valley sides, some floodplains and in the granite and coastal areas. Stands of broadleaved woodland, some ancient in origin and of national importance, are found on valley sides and bottoms and flank the estuaries of the south coast. The county is particularly riverine due to the impervious nature of the underlying rocks. Some of the rivers, their valleys and estuaries along with adjacent habitat are of national or international importance, having been designated or proposed as SSSIs or Special Areas of Conservation (SACs).

Coastal habitats such as sea cliffs, estuarine mud, beaches and sand dune systems are key features in the Cornish landscape and are important habitats for wildlife; however these are not dealt with in detail here as they are described in full in the profiles of the adjacent Maritime Natural Areas.

Some of the key habitats described in the following pages have been identified in the UK Steering Group Report on Biodiversity (1995) as key habitats for which costed action plans have been prepared. These are habitats for which the UK has international obligations, which are at risk or are rare, which are functionally critical, or which are important for key species. The names of habitat types used here do not always correspond with the UK Biodiversity Action Plan names, and a table relating the different habitat names with each other and with Phase 1 habitat types and National Vegetation Classification is provided in Appendix 1.

Habitat		Area(ha)	%
Mixed farmland (including Cornish hedges)	Arable	44661	19.5
	Improved grassland	128512	56.2
	Possibly unimproved grassland	4403	1.9
Unimproved grassland		672	0.3
Lowland heathland		1204	0.5
Mire (including wet heath)		1680	0.7
Broadleaved woodland (including willow carr) and parkland		18761	8.2
Conifers		4201	1.8
Scrub		3489	1.5
Bracken		1311	0.6
Rivers, streams and standing open water		507	0.2
Disturbed ground (including mines and derelict land)		489	0.2
Other		18895	8.3
Total		228785	99.9

* In order not to overlap too much with the adjacent Maritime Natural Areas, these figures have been derived by looking at all the habitat types inland of a line half a kilometre from the high water mark (except on the estuaries where the line is formed by the high water mark itself).

The key habitats found within the Natural Area are:

- Mixed farmland.** Most of the Natural Area consists of agricultural land. Although comprising generally small farms and small field sizes, much of the land is used for intensive dairy/beef production with silage and permanent improved pasture. The high rainfall and steep slopes of the Natural Area favour livestock farming as the most productive use of the land. Livestock require hedges for shelter, so many remain intact on pasture land. In localised areas there is intensive arable production including vegetables and bulbs.

Older enclosed farmland is considerably richer in wildlife than intensive agricultural land, but the traditional mix of arable land and pasture has decreased this century, with a trend towards more specialised pastoral farms. Mixed, low-intensity farmland supports a large number of species of insects, birds and mammals. Field margins often support coarse grassland communities, and, in some parts of the Natural Area, uncommon arable weeds such as purple ramping-fumitory, and increasingly rare species such as the skylark and linnet. Cirl buntings may hold on in parts of south Cornwall whilst there is a relict population of corn buntings at Pentire. Much of the more wildlife-rich farmland is found along the coast in the Pentire area north of Padstow. This area is amongst the key farmland biodiversity-rich areas of the South West. It could be richer still, eg if the chough, which used to breed on Cornish farmland, recolonised.

- **Cornish hedges.** Cornish hedges are of conservation significance as they provide a haven for plants and shelter for a diversity of invertebrates, small mammals and birds. Species of note which are particularly associated with Cornish hedges include Plymouth pear, Cirl bunting and several bat species. Hedges fulfil an important role in the countryside as "wildlife corridors", acting rather like linear strips of woodland edge or other semi-natural habitat in a sea of agricultural land. They are also often associated with roadside verge habitats. There are approximately 50,000km of Cornish hedge in the county.

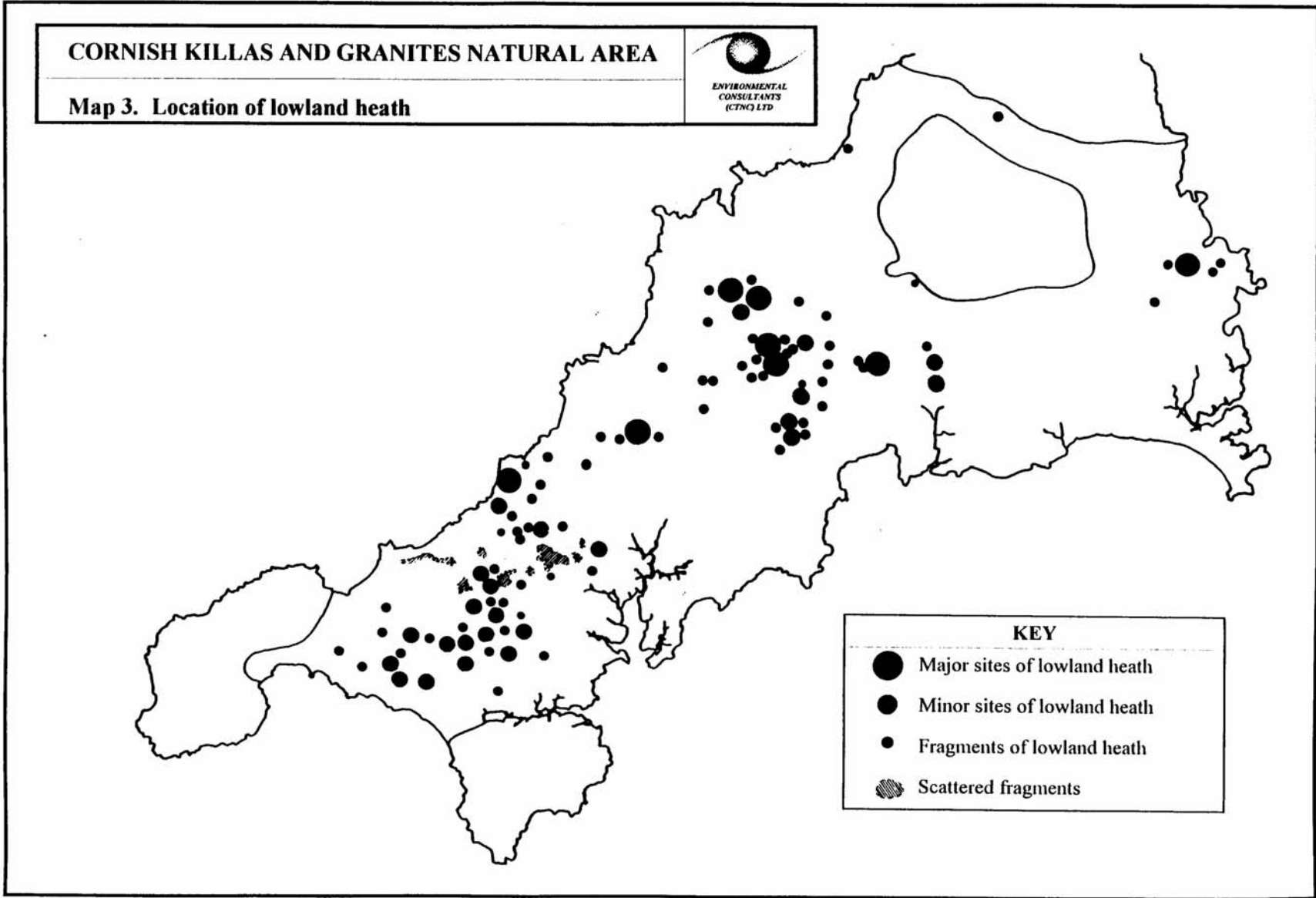
The appearance and construction of Cornish hedges varies throughout the Natural Area but in essence they are earth banks used as field boundaries, which may or may not be faced with stone. The construction traditionally varies according to the local geology and availability of stones. The amount of vegetation cover and its composition is very variable and depends on a number of factors, including the age of the hedge, the nature of the raw materials, the aspect and past and present management regimes. Many are ancient, showing field boundary patterns which have been in existence for centuries. They are a typically Cornish landscape feature, as this type of field boundary can otherwise be found only in Devon and occasionally in Brittany. Sometimes they are associated with "green" or "sunken" lanes, another characteristic and ancient feature of the rural Cornish landscape.

- **Lowland heathland.** Lowland heathland is generally found below 250m above sea level and was formed when prehistoric man cleared the primeval forests for fuel and timber. It is a rare and threatened habitat nationally, but Cornwall holds 11% of the national total, the second largest area of any of the counties. Heathland habitats in the Natural Area range from wet to dry and from maritime to terrestrial. The most common types within the Natural Area are wet heath, characterised by purple moor grass and cross-leaved heath, and humid heath (or western heath) dominated by heather, bristle bent and western gorse. They are usually found in mosaics with mire, willow carr and scrub. Heathland habitats support characteristic and diverse invertebrate and bird populations, and drier heaths are important within the Natural Area for common reptiles such as the adder and common lizard.

Much of the heathland within the Natural Area occurs on coastal cliffs (described in the Maritime Natural Area profiles) and the Mid-Cornwall Moors (*Map 3*), and several examples lie within SSSIs. Within the Mid-Cornwall Moors the main areas are the granite outcrops of Carnmenellis and St. Austell (which includes fragmented dry heaths and large tracts of wet heath and mire such as the National Nature Reserve (NNR) at Goss Moor), the Carrick heaths, where a characteristic element of the vegetation is the nationally rare Dorset heath, and St. Breock Downs. Smaller heathland remnants can also be found at Godolphin, Tregonning Hill and Kit Hill, the latter of which is a particularly important site for Dartford warbler. All dry heaths and Northern Atlantic wet heaths with cross-leaved heath are listed under Annex I of the EC Habitats Directive.

- **Mire.** Within the Natural Area, mire is often found associated with wet heath and willow carr (see above/below). It is formed on wet, boggy ground with impeded drainage, such as wet flushes and valley bottoms, and is characterised by purple moor grass, bog moss (*Sphagnum*), soft rush, bog asphodel and black bog rush. Several examples can be found within SSSIs and within the Goss Moor NNR. Mires provide

important habitat for many insect species, such as the nationally scarce small red damselfly and the internationally important marsh fritillary butterfly. The Natural Area is of outstanding national significance for wetland habitats in general.



- **Willow and alder carr.** Wet woodland in Cornwall is dominated by grey willow with occasional alder. The ground flora characteristically comprises abundant yellow flag, greater tussock sedge, hemlock water drop wort and opposite-leaved golden-saxifrage, and ferns such as lady fern and royal fern. The willows themselves support abundant mosses, liverworts and lichens. This type of habitat is found in wet areas with a high water table, such as valley bottoms and stream sides, and in mosaics with wet heath and mire. Several examples can be found within SSSIs and within the Goss Moor NNR. The Cornish Killas and Granites Natural Area is one of the key areas in England for this type of woodland.

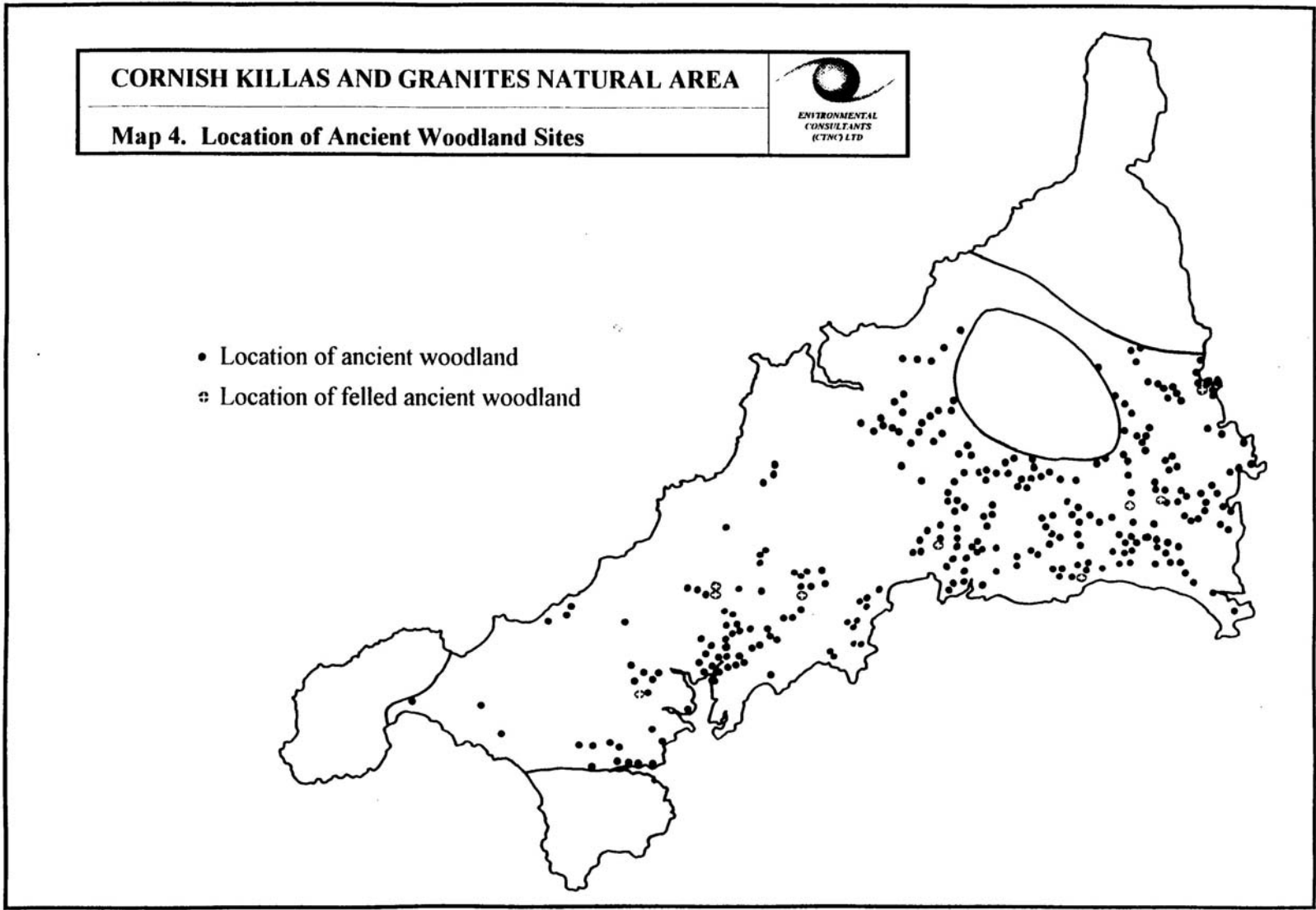
Along the margins of some estuaries willow carr forms part of an unusual transition of habitats from oak woodland through willow carr to saltmarsh. This transition from woodland to saltmarsh is increasingly rare in Europe and Britain. A particularly well-developed example of this transition occurs at Sett Bridge within the Upper Fal Estuary and Woods SSSI.

- **Herb rich unimproved grassland.** Much of the unimproved grassland of the Natural Area is found on the sides of the steep valleys which dissect the Cornish rural landscape. Here, fertiliser and other chemical application is uneconomic. Some herb-rich grassland derives from formerly improved meadows which are reverting to unimproved swards due to lack of management. Some of best herb-rich grassland is found on smallholdings which tend to receive little or no fertiliser. Truly unimproved grasslands such as the permanent pasture at Sylvia's Meadow SSSI, ancient hay meadows (like those at Carrine Common and Penweathers SSSI) and wet meadows (such as at Loggan's Moor SSSI) are very rare indeed. Acid grassland is found on some granite outcrops such as Carnmenellis. Road verges often contain species-rich grassland, and are characterised in the Natural Area by species such as early purple orchids. Unimproved grassland is found along the cliff tops and on the sand dune systems (described in the profiles of the adjacent Maritime Natural Areas), and there is a gradual transition from maritime communities to terrestrial communities further inland.
- **Broadleaved woodland.** Most of the broadleaved woodland in the Natural Area is "western oak woodland", a type which is characteristic of the Atlantic seaboard of Britain. It is dominated by sessile oak with occasional ash, and with hazel and holly the most common understorey species. Many woodlands are carpeted with bluebells in the spring; others are characterised by heather, bilberry, woodrush and common cow-wheat. The woodlands support rich communities of ferns, lichens, mosses and liverworts, as well as a diversity of invertebrates and breeding birds.

Some of the woodlands in the Natural Area are ancient semi-natural woodland (*Map 4*), meaning that they have had continuous tree cover since before 1600AD. (The assumption is that if a woodland has been present since 1600AD according to maps and records, it is likely to have been present for centuries or millennia before that.) Ancient semi-natural woodland is a habitat which now covers only 1% of the land surface of Britain. The structure of these woods varies depending on past and present management practices. Many woods in the Natural Area were coppiced on a rotational basis until this century, and the lack of recent management has resulted in even-aged stands with closed canopies. In the more inaccessible valleys where coppicing was not carried out, the structure of the woodland is much more varied.

Examples of this type of woodland are found in Crowhill Valley SSSI and Park Wood SSSI. Ancient semi-natural woodlands cover only 0.9% of the land surface of Cornwall and all are of at least county significance. Species of note associated with ancient semi-natural woodlands in the Natural Area include common dormouse, heath fritillary and Killarney fern.

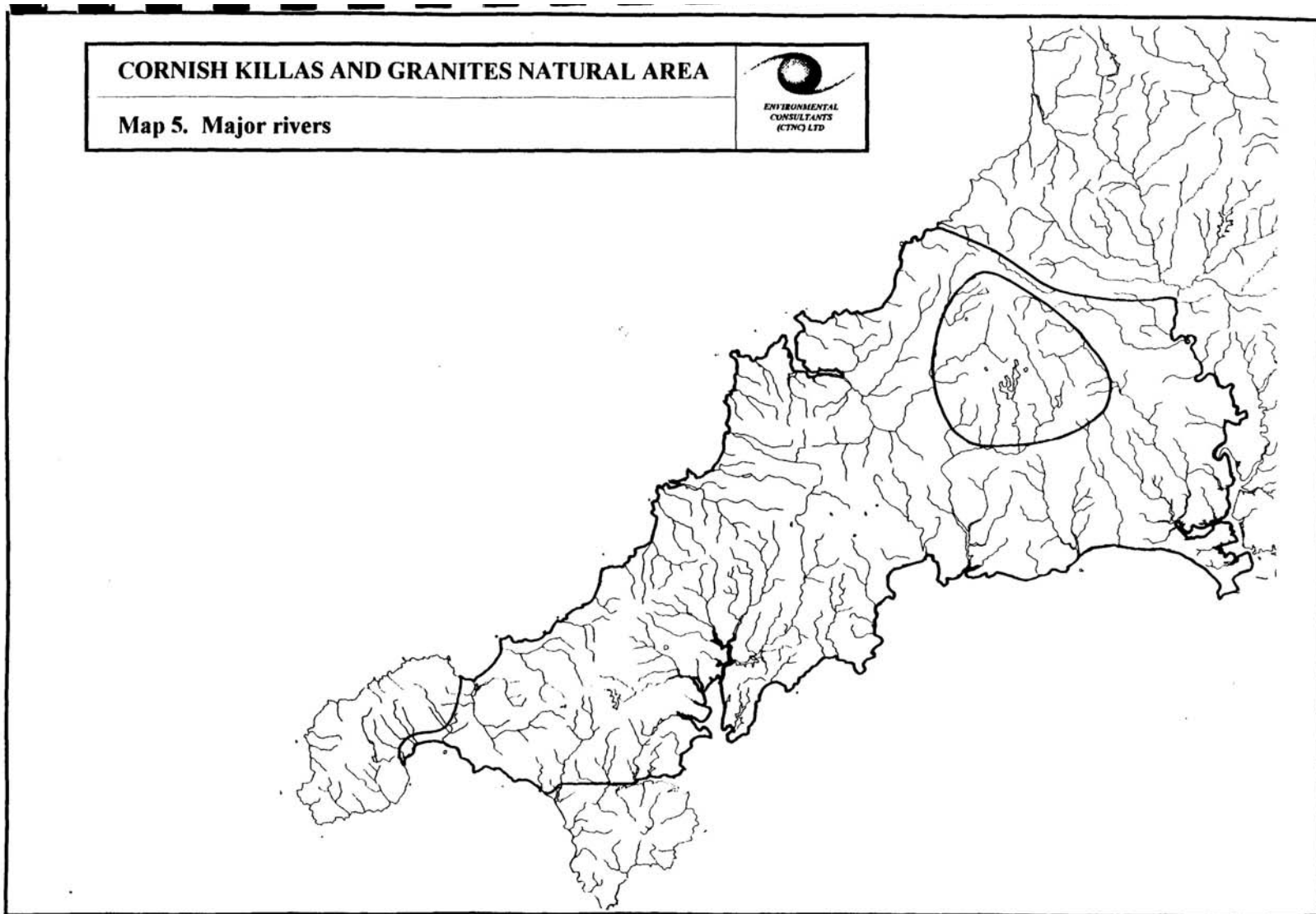
Most of the western oak woodland in the Natural Area is found along the fringes of the south coast estuaries, for example in the Upper Fal Estuary and Woods SSSI, and further up the river valleys. Other broadleaved woodland also occurs in these valleys and pockets survive in depressions inland. Approximately 6% of the land surface of the Cornish Killas and Granites is covered by broadleaved woodland (including ancient semi-natural woodland but excluding willow carr).



- **Mixed and coniferous woodlands.** Mixed and coniferous woodlands have replaced many of the broadleaved woodlands along the estuary fringes and in some areas inland, such as the Glynn Valley and the Tamar Valley. Although not supporting the diversity of species that ancient and other broadleaved woodlands support, mixed and coniferous woodlands are nevertheless of importance in a landscape where habitats other than agricultural land are increasingly fragmented, as they provide continuity of woodland habitat. They also provide food and shelter for a number of common bird and insect species, particularly where thinning has taken place so that light reaches the ground and a ground flora is present.
- **Rivers and streams.** The Cornish Killas and Granites Natural Area contains over 1,500km of rivers (*Map 5*). The underlying geology of the Natural Area, being largely impervious, contributes greatly to the numbers of streams and rivers present. The geology also affects the relative acidity of the water, which in turn affects the species found in the watercourses. The Natural Area's rivers and streams are important for populations of many common invertebrates and fish, but also for species of conservation concern such as Atlantic salmon, otters and water voles.

In the Natural Area, rivers and streams vary enormously in character and water quality. The profiles of some streams have been altered through canalisation (eg Red River) or through the deposition of unnatural growan (granite gravel) beds (eg upper Fal) as a result of mineral extraction activities. Many streams and rivers contain dense ochrous deposits and high levels of heavy metals in the sediments (eg Carnon River). Some suffer from poor water quality brought about by minerals leached from mine workings or by agricultural runoff. The flow rate, the amount of silt carried in suspension and the concentrations of pollutants all have an effect on the species composition of the watercourses. Riparian, or riverside, habitat such as tall herb marsh, reedbed and willow carr is an integral part of the riverine ecosystem and many species, such as otters, depend on it for food and shelter. It also plays a vital role as a buffer between the watercourse and adjacent agricultural land.

- **Standing open water.** There is very little natural open water habitat in the Natural Area, most of it lying in man-made reservoirs, china clay pits, tin-streamed areas or quarries. Small reedbeds, formed by dense stands of common reed, are often found associated with these bodies of water and with wet valley bottoms, such as the RSPB reserve at Marazion Marsh. Ponds are found scattered throughout the Natural Area, especially on farmland, wet heaths and mires and some derelict mine sites. Open water habitats and reedbeds are important for aquatic invertebrates and plants, and provide feeding or breeding grounds for a number of bird species.



- **Scrub.** Scrub is widespread in the Natural Area, occurring in association with many of the other habitat types. It often comprises dense thickets of small shrubby trees, especially willow (described earlier), hawthorn and blackthorn, and/or woody shrubs and climbers such as European gorse, bramble and honeysuckle. Scrub often marks the successional development of open habitat such as grassland or heathland into woodland, and can provide a buffer zone between these habitat types. Scrub is usually composed of plants which have plentiful edible flowers or fruit; this, combined with the often dense nature of this habitat provides excellent feeding opportunities and shelter for a wide range of common and less common insects, birds and small mammals. Dense, unmanaged scrub is a problem in some areas and needs management to maintain a mosaic of habitats.
- **Parkland.** Parklands consist of mature trees (mainly oak, ash and beech) scattered over grazed, often improved, pasture land. They can be ancient in origin, deriving from medieval deer parks; others formed part of the landscaped grounds of stately houses. Parkland is an uncommon and declining habitat in Europe and is most abundant in southern England. In the Natural Area, good examples of this habitat can be found at Boconnoc, Lanhydrock, Tregothnan and Trelissick.

The mature trees and dead wood support a rich diversity of mosses, liverworts and lichens and characteristic insects such as the distinctive merveille du jour moth. Boconnoc Park in particular is one of the richest parks in Britain in terms of its ancient woodland epiphytic lichens, supporting around 200 species including a number of rarities.

- **Mines and derelict land.** Much of the derelict land within the Natural Area is associated with old mines. Derelict mine sites are often havens for wildlife. Many have been colonised by heathland vegetation or scrub, which provide important habitats for invertebrates and birds. They are often too unstable to be developed, and the spoil and bare ground on many sites is contaminated by metals such as arsenic and copper, particularly in the west of the Natural Area. As a result, vegetation has been slow to colonise some former tin and china clay mine sites, benefitting certain scarce and rare species of mosses, liverworts and damselflies. Many derelict sites contain old mineshafts and adits. The inherent risks associated with access and development around mineshafts and adits mean that these sites are often relatively undisturbed. The numerous mine shafts in the Natural Area provide important roost sites for bats, all of which are protected by British and European legislation. The Natural Area contains one of the few known underground breeding roost in the British Isles of the endangered greater horseshoe bat.
- **Quarries.** Some provide rock face habitat where crevice-dwelling plants and invertebrates thrive. Some birds, such as peregrines, will nest on quarry ledges.
- **Coastal habitats.** Most of the coastal habitats found within the Natural Area, such as the intertidal zone, saltmarsh, cliff slope, maritime heath, maritime grassland and dune systems are described in the profiles of the adjacent Start Point to Land's End and Land's End to Minehead Maritime Natural Areas. However another potentially very important habitat within the Cornish Killas and Granites Natural Area is coastal farmland.

Much of the coast of Cornwall is made up of a strip of semi-natural habitats sandwiched between the marine environment on one side and agricultural land on the other. The vegetation is heavily influenced by exposure to wind and salt spray. Much of this semi-natural habitat is either relatively unaltered by humans due to its inaccessibility, therefore providing a refuge for many different species of plants and animals, or was traditionally grazed and is now neglected, scrubbing over with gorse and blackthorn. The farmland abutting this strip has an important role to play in the provision of feeding and hunting grounds for birds such as the corn bunting and peregrine which are now almost exclusively found on the coast as suitable habitat inland has disappeared.

4.1 Habitat Issues and Objectives

Since World War II, agricultural practices have intensified considerably, and areas formerly not worth improving can now be made more fertile by drainage and the application of fertilisers, leading to loss or degradation of semi-natural habitat such as heathland, mire and unimproved grassland. During this century there has been a move away from traditional mixed farming to specialised pastoral farming in common with much of western Britain. At the same time, grazing of coastal grassland and heathland has decreased dramatically, leading to a reduction in species diversity and an increase in the likelihood of accidental fires. Grazing of inland heath and mire has also decreased significantly.

Large areas of semi-natural habitat have been lost to minerals extraction, particularly the china clay industry, and commercial forestry this century. Development nibbles away at small areas of wildlife habitat, resulting in a large cumulative loss. Tourism, one of Cornwall's most important industries with demands on natural resources, doubles the population of Cornwall when flows in the rivers and streams are at their lowest, putting a strain on the water resource. Recreational activities also have an influence in localised "honeypot" areas, through erosion of footpaths and development. Yet more rich habitat is lost or damaged through neglect or mismanagement.

There is perhaps a greater potential, however, to halt and possibly reverse the trends in habitat loss and degradation in Cornwall than elsewhere in England since the agricultural potential of the land is not always as great as elsewhere. Opportunities for habitat restoration and management are available through agri-environment schemes such as Countryside Stewardship and the Wildlife Enhancement Scheme. These and other opportunities should be taken to ensure that the common plants and animals of our habitats remain common.

The major issues which cause loss or damage to the key habitats in the Cornish Killas and Granites Natural Area are outlined in Table 4, and objectives for their conservation are set out in Table 5.

Table 4. Habitat conservation issues

- **Agricultural policy**
 - Agricultural intensification
 - Application of fertilisers and pesticides
 - Drainage of wetlands
 - Loss of semi-natural habitat to arable or improved pasture
 - Unsustainable management
 - Removal or inappropriate management of hedgerows, disrupting wildlife corridors
 - Lack of funding for immediate work, eg repairs to Cornish hedges
 - Abstraction for irrigation reducing summer flows in watercourses
 - Effect of BSE (eg stock reduction) on semi-natural habitats
 - The move from mixed farming to predominantly specialised pastoral farming
- **Development**
 - Land fill developments
 - Extraction industries, eg china clay
 - Road construction schemes
 - Flood relief schemes (canalisation etc.)
 - Erosion caused by surface water runoff from impermeable surfaces
 - Landscaping of derelict mine sites
 - Loss of groundwater re-charge
 - Afforestation
- **Recreational pressures**
 - Erosion by walkers, motorbike scrambling, mountain bikes etc.
 - Facilities, eg golf courses, holiday centres
 - Mineshaft capping (for safety reasons)
- **Pollution**
 - Heavy metals in watercourses from old mine workings
 - China clay waste in watercourses
 - Organic pollution from agricultural runoff and sewage
- **Inappropriate habitat management**
 - Neglect of habitats, eg scrub invasion on heathlands
 - Mismanagement, eg overgrazing/undergrazing, inappropriate burning
 - Removal of management regime, eg cessation of coppicing leading to dense stands of even-aged trees
 - Lack of funding for habitat management
 - Lack of buffer zones between areas of semi-natural habitat and intensive agriculture
- **Lack of information/awareness of importance of semi-natural habitats, despite general public support**
 - Lack of co-ordinated advice to farmers and landowners on habitat management
 - Only “best” examples of semi-natural habitat protected
 - Lack of data on certain habitats
- **Habitat creation schemes**
 - Increasing semi-natural habitat resource
 - Schemes sometimes sited in inappropriate areas, eg ponds in wetland sites
 - Conflicts with other interests, eg archaeological, geological
 - Often not enough emphasis on native species of local provenance; also lack of local provenance sources
 - Country-wide schemes not necessarily appropriate to local area
- **Invasion of non-native species which choke out native vegetation, eg Japanese knotweed, rhododendron**
- **Forestry**
 - Felling and replanting of ancient woodland
 - Use of non-native species (and native species sourced from other countries)
 - Removal of dead wood
 - Lack of veteran trees

Table 5. Habitat conservation objectives
General objectives
<ul style="list-style-type: none"> ● Encourage further research into habitats <ul style="list-style-type: none"> - Identify all important areas of semi-natural habitat in the Natural Area - Monitor habitat change at specific sites which are being managed for wildlife, and continue to monitor change in the Natural Area as a whole - Carry out research into the ecologies of under-documented habitats ● Seek to protect sites which support important habitat types <ul style="list-style-type: none"> - English Nature and Cornwall Wildlife Trust to designate SSSIs and CNC sites where these designations would help conserve the features of interest - Protect habitats in the wider countryside which lie outside designated sites - Encourage conservation organisations to purchase important sites - Prevent further loss of important habitat types to agricultural improvements or development pressures ● Seek to influence agricultural policy to benefit wildlife <ul style="list-style-type: none"> - Promote sustainable farming practices and the benefits to both humans and wildlife of low intensity and mixed farming - Encourage availability and uptake of agri-environment schemes which provide incentives for farm extensification - Ensure that incentive rates for schemes which benefit wildlife on farms, including making funds available for immediate works, are at the correct level and address the means of achieving sustainable farming - Promote importance of farmland for wildlife (see below) ● Increase public awareness of the importance of semi-natural habitats <ul style="list-style-type: none"> - Inform landowners if they own or manage areas containing important habitats - Obtain funding to provide co-ordinated management advice to farmers and landowners - Inform farmers/landowners of financial incentives available for habitat management - Promote benefits of sustainable agriculture and sustainable development to the public - Increase awareness of knock-on effects of pollution and habitat mismanagement - Promote importance and proper management of Cornish hedges to highways authority and parish councils - Liaise with recreational, archaeological, geological and other interests over management of sites - Increase influence of conservation concerns upon development policies, ie promote sustainable environment/development approach ● Promote habitat restoration/re-creation schemes in appropriate areas <ul style="list-style-type: none"> - Identify areas suitable for habitat creation, particularly areas which recently supported semi-natural habitat or could provide links between areas of semi-natural habitat - Target funding to areas which would most benefit from habitat creation schemes - Review uptake of all incentive schemes for environmental management and restoration and determine why there is a poor uptake in Cornwall
Habitat-specific objectives
<ul style="list-style-type: none"> ● Promote and enhance the wildlife value of farmland <ul style="list-style-type: none"> - Promote and re-instate links between areas of semi-natural habitat in the rural countryside - Promote wildlife value of Cornish hedges and encourage appropriate management - Promote long term survival of current extensive network of Cornish hedges - Promote importance and appropriate management of arable areas (especially on coastal farmland) for rare and characteristic species, eg by providing winter stubble, not using herbicides, etc. - Promote low-intensity agriculture, especially adjacent to semi-natural habitat of nature conservation value - Promote the creation of farm ponds in appropriate locations, involving FWAG and/or EA in site selection

- **Maintain and manage existing areas of lowland heathland for wildlife and increase extent of heathland in Natural Area**
 - Ensure lowland heaths are managed appropriately by grazing and/or burning
 - Ensure wet lowland heaths continue to be fed by adequate supplies of unpolluted water
 - Identify areas of heath damaged by recreational pressure and reduce access as necessary
 - Target heathland re-creation to sites which have recently lost extensive tracts of heath, which have high re-creation potential and which will help link existing heathland fragments together, eg St Austell granite, St Breock Downs, Hingston Downs
- **Maintain, manage and enhance semi-natural broadleaved woodlands, particularly ancient woods and parklands and those within designated sites, with the aim of restoring to optimal condition for wildlife, and preferably with additional economic benefit**
 - Identify areas of broadleaved woodland which would benefit from coppicing, including areas of neglected coppice, and promote this management practice where appropriate
 - Prevent further loss of broadleaved woodland to conifers, especially in ancient woodlands
 - Restore native tree cover to areas of ancient woodland previously planted with conifers and reduce cover of other non-native species where spreading in all woodlands
 - Promote appropriate management to increase structural diversity, including the retention of dead wood
 - Encourage tree planting on suitable sites where the broadleaved woodland resource has been significantly depleted, and to link areas of woodland together, eg valley bottom to hillside woods
 - Ensure long-term survival of veteran trees
 - Plant replacement trees in parkland to provide continuity of cover and veteran trees of the future
 - Ensure areas of willow carr continue to be fed by adequate supplies of unpolluted water
 - Manage willow carr to vary age structure and prevent encroachment onto valuable heathland and wetland
- **Ensure that the nature conservation importance of derelict mine sites is incorporated into their future management**
 - Protect sites with important wildlife features and provide on-site interpretation
 - Carry out research into ecology and wildlife importance of derelict mine sites
 - Prevent spread of non-native species where they are out-competing the native flora
 - Promote the wildlife value of these sites
- **Conserve areas of herb-rich unimproved grassland, maximising their plant diversity and faunal interest**
 - Manage herb-rich grasslands appropriately as hay meadows or grazing pastures to maintain species diversity and prevent invasion of coarse grasses and scrub
 - Ensure wet species-rich meadows continue to receive unpolluted water
 - Restore areas of semi-improved grassland to optimal condition for nature conservation
 - Expand the herb-rich grassland resource
- **Ensure quality of aquatic habitats in Natural Area is maintained**
 - Conserve and improve water quality of watercourses and waterbodies
 - Promote appropriate management of riparian habitats
 - Prevent further canalisation of watercourses to ensure that channel form and banks remain undisturbed; prevent construction of weirs and other obstructions
 - Encourage installation and maintenance of buffer zones between crops and watercourses
 - Prevent proliferation of abstraction consents, especially in catchments which suffer from low summer flows
- **Maintain and manage areas of wetland (mire, reedbed etc.) for wildlife**
 - Maintain and enhance the current extent, diversity and condition of wetland habitats
 - Promote the wildlife value and appropriate management of wetland sites
 - Restore and enhance the hydrology and water quality of wetland sites that are currently in sub-optimum condition
 - Promote creation of wetland habitats for their buffer function as well as for their intrinsic value, eg in water treatment, to take up nitrogen and settle out silt

5 Species

The range of semi-natural habitats in the Cornish Killas and Granites Natural Area supports a high diversity of plants and animals. Physical factors such as climate, exposure, soils and drainage greatly influence the species present in the Natural Area. The mild climate, influenced by the Gulf Stream, encourages several plants and animals which are at the northern limit of their range in Europe. The mildness, combined with a wet and humid maritime climate, favours a number of western or “Atlantic” species, eg lichens and bryophytes. The proximity to the marine environment favours salt-tolerant species, especially where exposure to salt spray is greatest. The soils and drainage influence the species diversity of vegetation through the availability or otherwise of nutrients and water.

Human activity has had a profound influence on the species of the Natural Area, through our use of the natural resources and more recently through pollution. Humans have been present on the Cornish peninsula for several thousand years, and in that time have drastically altered the natural species composition primarily through woodland clearance, minerals exploitation and agriculture.

The Natural Area is notable for its numbers of scarce or rare plants and invertebrates, many of which are restricted by climatic preferences to Cornwall or Southwest England. The Natural Area also supports ten species of bat, all of which are dependent on the diversity of habitats present in close proximity, supporting countless insect species. The essentially riverine nature of the area means it has strong populations of aquatic species, such as Atlantic salmon, and species like the otter which declined dramatically in the 1950s and 1960s are making a steady recovery. The heaths, especially those near the coast, are important for common reptiles. Over 400 species of national or international conservation importance are to be found here. Still more are highly valued by the public as they form part of people's perceptions of the Natural Area.

Key species of the Cornish Killas and Granites can be selected using the following criteria:

1. Species that are believed endemic to the UK and which have viable populations in the Cornish Killas and Granites Natural Area.
2. Species which are threatened on a global or European scale (ie which are included in the long list of globally threatened/declining species in the UK Biodiversity Steering Group Report (1995)) and which have significant populations in the Cornish Killas and Granites Natural Area.
3. Species which are rapidly declining throughout Great Britain (ie which have undergone a 25-100% decline in numbers or range in Great Britain in the last 25 years) and which have a stronghold in the Cornish Killas and Granites.
4. Species which are threatened in Great Britain, being listed in the relevant Red Data Book.
5. Species which are highly characteristic of the Cornish Killas and Granites, being seldom found in such numbers elsewhere in England, and which are popular with the general public.

The species groups represented by key species in the Natural Area are:

- **Lower plants.** This group comprises algae, stoneworts, lichens, bryophytes (mosses and liverworts) and fungi. The Natural Area is particularly important for its communities of lichens and bryophytes, through a combination of its mild and wet climate, the habitats present (such as metal-contaminated mine spoil and ancient woodlands), and its relatively clean air. Very little is known about the status of some groups, eg fungi, as they are extremely under-recorded.

The sensitivity of lichens to air pollution has been used to create a national pollution scoring system based on the lichen species found. A value of 0 is assigned to zones with most pollution, indicating levels of sulphur dioxide present, and a value of 10 is given to zones with "pure" air. Almost the whole of Cornwall falls within zones 9 and 10. Golden-hair lichen (RDB2) is an example of a pollution-sensitive lichen which has undergone a catastrophic decline since the Industrial Revolution and which is now almost entirely confined to Southwest England.

Many of the bryophytes found within the Natural Area are colonists of bare soil, such as the RDB moss *Weissia multcapsularis*. The high levels of heavy metals associated with derelict tin and copper mines often render the ground at these sites sterile to higher plants, leaving this ecological niche open to metal-tolerant bryophyte species. *Cephaloziella nicholsonii* (RDB3) is an example of a copper-tolerant liverwort; this species is believed to be endemic and 11 of its 21 British sites are found in the Cornish Killas and Granites Natural Area. The Natural Area also supports a population of the western rustwort, the only terrestrial species in Britain to be listed under the EC Habitats Directive as a "priority" species.

- **Ferns and flowering plants.** The geographical position of the Cornish Killas and Granites Natural Area, amongst other factors, contributes to the diversity of higher plant species found here. The adjacent Lizard Natural Area, the most southerly on the British mainland, is famous world-wide for its unique assemblages of plants and number of rarities, and the Cornish Killas and Granites boasts many rarities and other species of interest of its own. Many are dependent on particular habitats, such as the nationally rare Martin's ramping fumitory which requires regularly disturbed ground such as is found in allotments and cultivated field borders. Flowering plants such as primroses, bluebells and early purple orchids are common in, and characteristic of, the Natural Area.
- **Insects and other invertebrates.** Again, many of the 200 or so rare and scarce invertebrates found in the Natural Area are dependent on climatic conditions and/or particular habitat requirements. For example, the nationally scarce blue-tailed damselfly favours shallow, ephemeral pools with sparse vegetation; this damselfly has a markedly south-western distribution with one of its core populations in the Cornish Killas and Granites Natural Area.
- **Fish.** The Natural Area is crossed by over 1,500km of rivers and streams and so provides ample habitat for many species of fish (although Cornish watercourses are characterised by a general absence of coarse fish species, perhaps due to the prevalence of fast-flowing rivers and streams). Sustainable populations of Atlantic

salmon are found in the largest catchments, and eel and brown/sea trout are common and widespread.

- **Amphibians and reptiles.** Cornwall has a lower amphibian density than other counties; this is perhaps due to its relative paucity of ponds, despite the abundance of good terrestrial habitat. However it is a stronghold for the palmate newt, which favours acidic waters. The dry heathland and grassland habitats of the Cornish Killas and Granites are ideal for reptiles, particularly the adder, and Cornish hedges provide excellent habitat for common lizards - there is said to be at least one in every hedge!
- **Birds.** The Natural Area supports a wide range of common farmland birds, such as skylark, whose populations are generally comparable to or higher than populations elsewhere in England and Wales. The mild climate is also an important factor in determining which species thrive here: Cetti's warbler, for example, is on the northern edge of its geographical range in Cornwall. Buzzard is a western species which occurs in relatively large numbers in the Cornish Killas and Granites. The coastal cliffs and adjacent terrestrial habitats are important for populations of stonechat, corn bunting, peregrine, raven and once supported the chough - an indicator of quality coastal habitats which we want to see return.
- **Mammals.** The complex mosaic of habitats in the Natural Area provides food and shelter for many small mammal species. The badger is very common in Cornwall, although thought to be declining on an international level. The otter, having suffered a drastic decline in numbers since the 1950s, has begun to extend its range in the Natural Area and is present in significant numbers compared with the rest of England and Wales. Many bats, like pipistrelles, find the mix of land-uses in the Natural Area ideal, and for some of the rarer species, such as the horseshoe bats, the Cornish populations are extremely important in a national context. In the case of the greater horseshoe bat, two of only twelve known breeding roosts in the country are found in the Cornish Killas and Granites Natural Area.

About 300 key species, selected using the criteria given above, are listed in Appendix 2. Because of the limitations on human and financial resources it is impractical to focus conservation attention on them all. Priorities for action must therefore be identified. This does not mean that other equally deserving species will be neglected, as the habitat conservation measures put in place by definition will go a long way to conserving the remaining species which rely on those habitats.

Table 6 lists 41 species that may be regarded as "priority action" species for the Cornish Killas and Granites. These have been pulled out from the list of key species by selecting those which are most vulnerable, those whose conservation will ensure the survival of a number of other key species at the same time, and those which contribute essentially to the character of the Natural Area. Although 41 seems a large number, some of these species are very localised and will require very specific action.

Table 6. Priority Action Species				
Latin name	English name	Reasons for selection	Habitat requirements	Objective
<i>Graphina pauciloculata</i>	a lichen	Endemic to Britain and Ireland. Found in Cornwall and Devon.	Ancient woodlands.	Maintain populations.
<i>Parmelia minarum</i>	New Forest parmelia	Known only from New Forest and Cornwall in Britain.	Ancient woodlands and parklands.	Maintain populations.
<i>Teloschistes flavicans</i>	Golden-hair lichen	Catastrophic decline this century due to air pollution; now mainly found in southwest England.	Woodlands, scrub and rocks.	Maintain populations.
<i>Ditrichum subulatum</i>	a moss	Confined to Cornwall in UK. Not found since 1979.	Colonist of unstable substrates.	Re-survey populations and maintain if found.
<i>Weissia multicapsularis</i>	a moss	Known only from England and France. Declining. Records suggest Natural Area is a national stronghold, but not found here since 1967.	Colonist of bare ground.	Re-survey populations and maintain if found.
<i>Cephaloziella integerrima</i>	a liverwort	Recently rediscovered in Natural Area. Only extant site in Britain.	In Natural Area, recorded from slaty soil in a quarry; elsewhere, from mine spoil and lowland heathland.	Monitor and maintain known population. Re-survey other populations and maintain if found.
<i>Cephaloziella nicholsonii</i>	a liverwort	Endemic to UK. Records suggest Natural Area is a national stronghold.	Copper contaminated substrates where vascular plant growth is inhibited.	Monitor and maintain known populations.
<i>Jamesoniella undulifolia</i>	Marsh earwort	Always rare; now thought to be rapidly declining.	<i>Sphagnum</i> -rich mires.	Re-survey former stations and potential sites. Maintain populations if found.
<i>Marsupella profunda</i>	Western rustwort	Confined to three sites in UK, one in Natural Area and two in adjacent West Penwith. Declining.	Colonist of bare ground. In Cornwall, found in disused china clay works.	Maintain populations at known sites. Survey potential sites and maintain if found.
<i>Trichomanes speciosum</i>	Killamey fern	Globally threatened.	Damp, deeply shaded stream ravines and caves.	Maintain at known sites.
<i>Chamaemelum nobile</i>	Chamomile	Rapidly declining.	Grazed sandy grasslands and heathlands.	Re-survey populations and maintain if found.
<i>Euphrasia vigursii</i>	Vigur's eyebright	UK endemic, found in Devon and Cornwall. Declining due to habitat destruction.	Heathland.	Maintain populations at known sites.
<i>Fumaria occidentalis</i>	Western ramping fumitory	UK endemic, confined to Cornwall and Isles of Scilly. Declining due to removal of hedgebanks and increased herbicide use.	Hedges and field margins.	Maintain range.
<i>Fumaria purpurea</i>	Purple ramping fumitory	Possibly UK endemic. Mainly found in southwest England.	Hedges and field margins.	Maintain range.
<i>Fumaria reuteri</i> ssp. <i>martinii</i>	Martin's ramping fumitory	Only known from Cornwall and Isle of Wight. Declining.	Field borders and allotments.	Monitor and maintain existing populations.
<i>Lycopodiella inundata</i>	Marsh clubmoss	One record for Cornwall. Declined throughout Europe.	Grazed wet heathland and mire.	Monitor and maintain existing population.

Table 6. Priority Action Species (cont.)				
Latin name	English name	Reasons for selection	Habitat requirements	Objective
<i>Pyrus cordata</i>	Plymouth pear	Known from Cornwall and Devon in UK. Local in Europe.	Hedgerows and road verges.	Maintain existing populations.
<i>Ranunculus tripartitus</i>	Three-lobed water-crowfoot	Declining rapidly. Restricted to south and south-west England. Taxonomy of potential Cornish populations unclear.	Mud and shallow seasonal pools on heathland.	Re-survey former stations and maintain if found. Resolve problems of taxonomic status.
<i>Ischnura pumilio</i>	Scarce blue-tailed damselfly	With a south-western distribution in Britain, this species has a national stronghold in the Natural Area.	Shallow ephemeral pools with sparse vegetation, often on mine sites.	Maintain populations and range.
<i>Lucanus cervus</i>	Stag beetle	Declining due to habitat loss.	Broadleaved woodland, parkland and gardens where there is dead wood available.	Halt decline.
<i>Argynnis adippe</i>	High brown fritillary	Declined by 94% nationally since the 1950s. Now very localised and rare.	Slopes with bracken.	Halt decline in numbers and contraction in range.
<i>Boloria euphrosyne</i>	Pearl-bordered fritillary	Rapidly declined over last 50 years in southern England due to cessation of traditional forms of land management.	Woodland clearings; unimproved grassland with scrub or bracken.	Halt decline in numbers and contraction in range.
<i>Eurodryas aurinia</i>	Marsh fritillary	Declining throughout Europe due to habitat loss and fragmentation. Still widespread in southwest England and Wales.	In Natural Area, breeds in damp neutral or acidic grasslands.	Maintain range and increase populations.
<i>Jodia croceago</i>	Orange upperwing	Declining throughout Europe. Confined to Cornwall, Devon and Surrey in UK.	Ancient woodland.	Maintain populations and range.
<i>Mellicta athalia</i>	Heath fritillary	Declined by 65% nationally since the 1960s. In UK, confined to Kent, Somerset, Devon and Cornwall.	Woodland clearings and rides.	Maintain populations and extend range.
<i>Bombus sylvarum</i>	Shrill carderbee	Declining due to agricultural intensification.	Herb-rich rough grassland.	Re-survey former stations. Maintain populations if found.
<i>Asilus crabroniformis</i>	a robber fly	Declining due to habitat loss and fragmentation.	Unimproved and semi-improved grassland and heathland.	Halt decline in numbers and contraction in range.
<i>Acrocephalus paludicola</i>	Aquatic warbler	Globally threatened due to loss and degradation of habitat. Large proportion of global population passes through Britain on migration. Natural Area contains one of Britain's most important sites.	Bulrush and reed beds.	Maintain and protect key sites.
<i>Cettia cetti</i>	Cetti's warbler	National stronghold within Natural Area. Susceptible to severe winters and unsympathetic habitat management.	Scrubby wetlands and reedbeds.	Maintain populations.
<i>Circus cyaneus</i>	Hen harrier	Significant wintering population (long-term 1% of British population) at one site.	Mature heather moorland.	Maintain wintering populations.
<i>Circus pygargus</i>	Montagu's harrier	Former stronghold in Cornwall. Last bred 1975. Declines largely due to factors abroad.	Heaths with wet valley vegetation. Young conifer plantations.	Review status in Natural Area. Maintain suitable habitat conditions.

Table 6. Priority Action Species (cont.)				
Latin name	English name	Reasons for selection	Habitat requirements	Objective
<i>Emberiza cirlus</i>	Cirl bunting	Endangered in Britain. National stronghold in adjacent South Devon Natural Area, breeding rarely in Comish Killas and Granites. Susceptible to severe winters and changes in farming practices, e.g. the change from spring-sown to winter-sown cereals.	Scrub and tree-lined hedges adjacent to arable land.	Encourage re-expansion of range to formerly occupied sites from adjacent Natural Area.
<i>Lullula arborea</i>	Woodlark	Once widespread in small numbers, last bred in 1983.	Low, mosaic vegetation with some bare ground; smallholdings and market gardens.	Re-establish viable breeding population in Natural Area.
<i>Miliaria calandra</i>	Corn bunting	In long term decline due to intensification of agricultural practices. Its conservation would help maintain populations of other farmland species.	Mixed, low-intensity farmland.	Halt decline in numbers and contraction of range.
<i>Perdix perdix</i>	Grey partridge	Heavy decline in Natural Area. Susceptible to changes in agricultural practices.	Low intensity arable farmland with hedgerows, particularly with rough field margins.	Halt decline in numbers and contraction of range.
<i>Pyrhocorax pyrrhocorax</i>	Chough	Last bred in 1947 after protracted decline. Last resident individual died in 1973.	Mixed coastal farmland/heathland.	Re-establish viable breeding population in Natural Area.
<i>Tyto alba</i>	Barn owl	Significant but declining population in Natural Area. Susceptible to changes in agricultural practices, particularly loss of rough grazing and use of pesticides. Popular with general public.	Lowland low-intensity farmland.	Halt decline in numbers.
<i>Arvicola terrestris</i>	Water vole	70% decline at known sites this century due to habitat destruction and fragmentation, plus predation by mink. Status in Natural Area uncertain.	Well-vegetated, slow-flowing ditches, rivers and streams with steep banks.	Research status and distribution. Halt long-term decline and extend range.
<i>Lutra lutra</i>	Otter	Significant population present in Natural Area. Now expanding in numbers and range after widespread decline caused by use of persistent agricultural pesticides and habitat destruction. Popular with general public.	Rivers, lakes and coasts.	Continue to extend range and promote as an indicator of good water quality.
<i>Muscardinus avellanarius</i>	Common dormouse	In long term decline due to habitat loss and fragmentation. Popular with general public.	Broadleaved woodland with well-developed understorey; hedges.	Halt and if possible reverse decline.
<i>Rhinolophus ferrumequinum</i>	Greater horseshoe bat	Catastrophic decline (est. 98%) this century, latterly due to intensification of farming practices and loss of suitable breeding roost sites. 2 of the 12 known British nursery roosts are in the Natural Area.	Pasture and broadleaved woodland near suitable roost sites (mines, stone bams).	Protect and maintain all potential roost sites. Ensure appropriate habitat management around roost sites. Monitor and maintain populations.

A number of species are thought to have become extinct within the Natural Area this century, a selection of which are shown in Table 7. The sheer number of species now believed to be extinct highlights the need to avoid complacency about the state of biodiversity within the area; constant vigilance will be required to prevent further extinctions.

Table 7. Species which have become extinct in the Natural Area this century				
	<i>Latin name</i>	English name	Date last recorded	
Lower plants:	<i>Ditrichum cornubicum</i>	Cornish path-moss	1963	
Vascular plants:	<i>Ajuga genevensis</i>	Blue bugle	ca. 1970	
	<i>Anthoxanthum aristatum</i>	Annual vernal-grass	pre-1909	
	<i>Caucalis platycarpus</i>	Small bur-parsley	ca. 1925	
	<i>Corrigiola litoralis</i>	Strapwort	1930s	
	<i>Euphorbia peplis</i>	Purple spurge	1949	
	<i>Galium pumilum</i>	Slender bedstraw	1901	
	<i>Otanthus maritimus</i>	Cottonweed	1933	
	<i>Phyteuma spicatum</i>	Spiked rampion	1927	
	<i>Sisymbrium irio</i>	London rocket	1926	
	Insects:	<i>Aeshna grandis</i>	Brown aeshna	1986
<i>Brachytron pratense</i>		Hairy dragon fly	1976	
<i>Coenagrion mercuriale</i>		Southern damselfly	1957	
<i>Coenagrion pulchellum</i>		Variable damsel fly	1987	
<i>Erythromma najas</i>		Red-eyed damsel fly	1906	
<i>Maculinea arion</i>		Large blue butterfly	1979	
<i>Margaritia sticticalis</i>		a pyralid moth	pre-1976	
<i>Nymphalis polychloros</i>		Large tortoiseshell	1983	
Birds:		<i>Anas quercquedula</i>	Garganey (breeding)	1983
		<i>Anser albifrons</i>	White-fronted goose (wintering)	1974 (last regular)
	<i>Asio flammeus</i>	Short-eared owl (breeding)	1947	
	<i>Charadrius hiaticula</i>	Ringed plover (breeding)	1972	
	<i>Circus pygargus</i>	Montagu's harrier (breeding)	1975	
	<i>Crex crex</i>	Corncrake (breeding)	1967	
	<i>Lanius collurio</i>	Red-backed shrike (breeding)	1968	
	<i>Lullula arborea</i>	Woodlark (breeding)	1983	
	<i>Pyrrhocorax pyrrhocorax</i>	Chough (breeding)	1947	
	Mammals:	<i>Mustela putorius</i>	Polecat	ca. 1942
<i>Sciurus vulgaris</i>		Red squirrel	ca. 1973	

Some species may be colonising or re-colonising the Natural Area, either naturally or through re-introduction programmes. These include sand lizard and red kite, both being re-introduced to parts of South West England through English Nature's Species Recovery Programme.

5.1 Species Issues and Objectives

The intensification in agricultural practices since World War II has resulted in the loss and degradation of large areas of semi-natural habitat, which in turn has led to a reduction in species diversity and numbers. Other land uses such as mineral extraction, forestry, development and tourism have also led to habitat losses this century but continue to have an influence on the nature conservation interest by creating new habitats, eg flooded disused quarries can be quickly colonised by damselflies and dragonflies. Some human activities may affect species populations through disturbance, eg increased access to beaches was thought to be a factor in the decline of the ringed plover and may be having an impact on grey seals.

There are opportunities to halt the declines in certain species populations through re-introduction, appropriate habitat management and restoration under schemes such as the Wildlife Enhancement Scheme and the Species Recovery Programme.

Issues affecting the species numbers and diversity of the Cornish Killas and Granites Natural Area are outlined in Table 8. Objectives for Priority Action Species have already been proposed (see Table 6) and objectives for the conservation of all species numbers and diversity in the Natural Area are outlined in Table 9.

Table 8. General species conservation issues

- **Pollution**
 - Decline in species health, leading to local extinctions, eg air pollution sensitive lichens
 - Genetic change over time caused by persistent toxins, eg pesticide residues
 - Reduction in species diversity through application of chemicals both to land and to farm animals
 - Roadside species compositions altered and diversity reduced by pollutants, eg salting roads
 - Build-up of organic compounds in food chain causing long-term problems, eg eggshell thinning
 - Possible over-use of chemicals in gardens
- **Loss or damage to habitats**
 - Loss or damage to habitats (for reasons described in *Section 4*) which provide, shelter, food or breeding sites
 - Fragmentation of habitats leading to isolation of species populations
 - Disruption of wildlife corridors (such as hedges) restricting movement of species through the countryside, with threat of possible extinctions
 - Replacement of traditional mixed farming with intensive grazing or monoculture crops reducing species diversity
- **Inappropriate habitat management**
 - Inappropriate habitat management (for reasons described in *Section 4*) leading to deterioration of habitat quality for many species
 - Lack of co-ordinated advice to farmers and landowners on habitat management
- **Lack of knowledge of ecology and habitat requirements of certain species groups**
 - Lack of understanding of certain habitats
 - Lack of data on certain species groups, eg fungi, mammals
- **Lack of public awareness despite general public sympathy**
 - Effect of disturbance due to human activity on breeding success
 - Road kills
 - Lack of understanding of effects of human activities, eg picking wild flowers etc.
 - Lack of understanding of knock-on effects of human activities, eg spraying garden with insecticides
- **Re-introductions**
 - Helps ensure nationally declining populations remain viable in the long term
 - Danger of focussing too much attention on re-introducing rare or extinct species
- **Species protection**
 - Only some rare species statutorily protected
- **Invasion of alien species which out-compete native flora and fauna**

Table 9. General species conservation objectives

- **Encourage further research and surveys into key species groups**
 - Promote research into under-recorded species groups, eg mammals, invertebrates, fungi, fish
 - Identify sites which support important species populations
 - Promote research into habitat requirements of key species
 - Survey sites to determine whether certain species are now extinct in the Natural Area
- **Protect sites which support key species populations**
 - Liaise with English Nature and Cornwall Wildlife Trust over the designation of SSSIs and the identification of CNC sites
 - Encourage conservation organisations to purchase sites which support important species
 - Liaise with relevant organisations over natural resource management, eg Environment Agency, South West Water, Forestry Commission, English China Clays
- **Maintain and enhance populations of key species through appropriate habitat management**
 - Maintain viable (meta)populations of all Priority Action Species at all current locations
 - Create conditions suitable for Priority Action Species where new sites are needed to ensure the species' continued health in the Natural Area
 - Halt decline in diversity and quality of habitats within the Natural Area
 - Increase levels of funding for environmental management which benefits wildlife
 - Encourage change towards sustainable, mixed, low-intensity farming
 - Encourage creation and maintenance of buffer zones between semi-natural habitats and intensive agriculture
 - Re-instate, manage and enhance wildlife corridors between areas of semi-natural habitat in the countryside to enable species dispersal
- **Promote appropriate habitat management**
 - Increase funding for land management advice
 - Liaise with highways authority over appropriate management of roadside habitats
 - Liaise with appropriate ministries to reduce pollution levels
 - Promote sustainable development
- **Provide education/information to the general public**
 - Emphasise habitat management for the common in order to keep them common
 - Increase awareness of knock-on effects of pollution, unsustainable utilisation of natural resources, etc.
- **Re-introduce species which have recently been lost from the Natural Area**
- **Increase protection for rare species**

6 Prime biodiversity areas

Prime Biodiversity Areas (PBAs) are areas where limited financial resources can be targeted most effectively so that the key habitats and species of the Natural Area can be maintained and enhanced (Batten, 1994).

Within the Cornish Killas and Granites, there are several areas which could be identified as PBAs (*Map 6*). The areas containing the highest overall biodiversity and which best represent the character of the Natural Area are:

- River Camel, its tributaries and estuary, including Pentire area - high geological, habitat and floristic diversity; key species: otter, corn bunting, Atlantic salmon, little robin
- South coast estuaries and river valleys - the Fal, Helford (north bank), Fowey, East and West Looe, Seaton and Tamar which provide important links between coastal and inland habitats and support many of the remaining ancient semi-natural woodlands; key species: greater horseshoe bat, New Forest parmelia, heath fritillary
- Roseland peninsula - mixed, coastal farmland with species-rich hedges; key species: skylark, *Weissia multicaulis*
- Mid-Cornwall Moors - large expanses of wet heath, mire and willow carr; key species: marsh fritillary, marsh clubmoss, hen harrier
- Carrick heaths area - low-intensity mixed farming, species-rich hedges, humid heaths, wooded valleys; key species: Plymouth pear, Dorset heath



Areas which have the best potential for linking fragmented habitats or for increasing the overall biodiversity are:

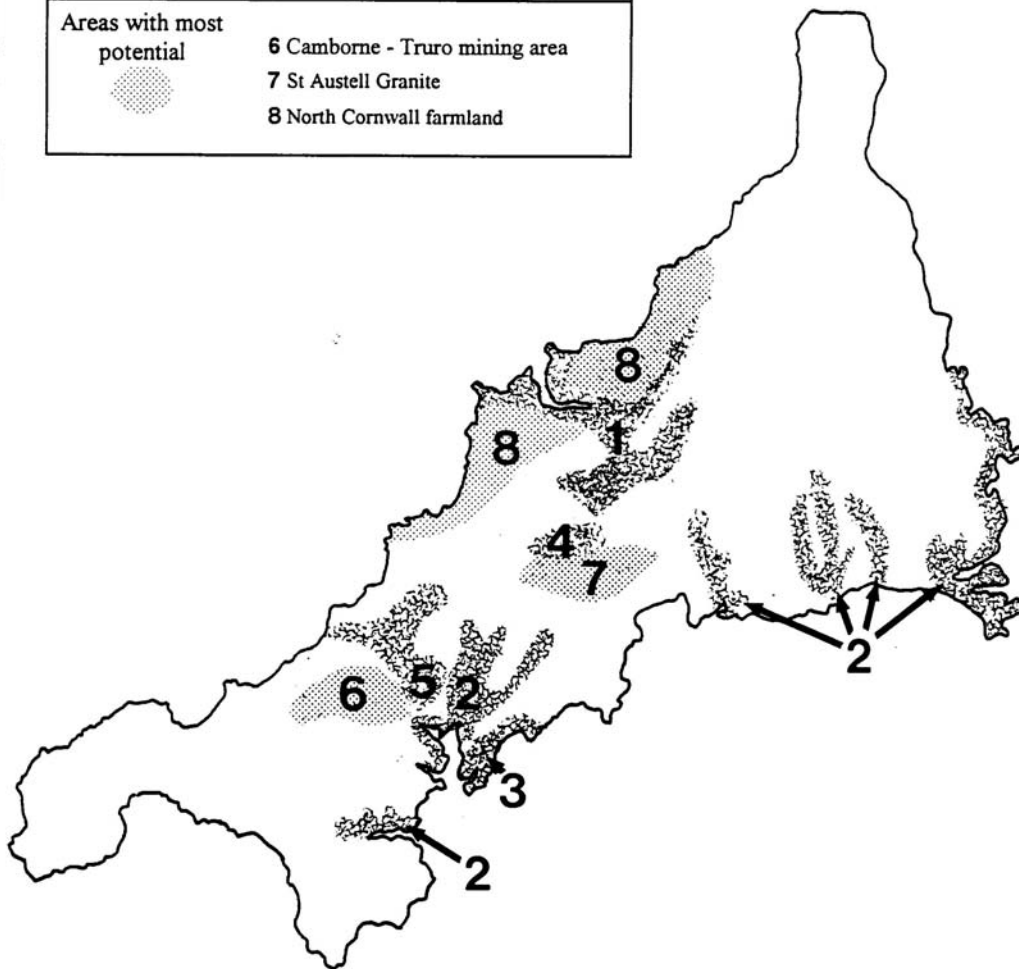
- Former tin-mining areas between Camborne and Truro - distinctive landscape with Cornish engine houses and great archaeological/historical value; heathland re-creation potential but also valuable bare ground habitats, currently either unmanaged or under threat from recreational pressures; key species: *Cephaloziella nicholsonii*, scarce blue-tailed damselfly, greater horseshoe bat
- St Austell granite - exploited for china clay reserves; fragments of heathland remain between the quarries and heath is naturally recolonising the spoil heaps; high re-creation potential
- North coast farmland - recently suffered from intensification and major hedgerow losses, but close to reservoirs of biodiversity such as coastal strip, Camel estuary area and Bodmin Moor; high potential for restoration of hedgerow network as wildlife corridors and installation of buffer zones

CORNISH KILLAS AND GRANITES NATURAL AREA



Map 6. Prime Biodiversity Areas

KEY	
Areas with high biodiversity 	1 Camel Estuary and Pentire
	2 South coast estuaries and river valleys
	3 Roseland Peninsula
	4 Mid-Cornwall Moors
	5 Carrick Heaths
Areas with most potential 	6 Camborne - Truro mining area
	7 St Austell Granite
	8 North Cornwall farmland



7 Who Can Contribute?

Significant progress in realising a nature conservation strategy for the Cornish Killas and Granites Natural Area can only be made if all the individuals and organisations involved in its management pull together with a shared Vision for the Future.

Action, co-operation and involvement will be needed from:

- landowners, farmers and the local community
- conservation and countryside management bodies such as English Nature, the National Trust, Cornwall Archaeological Unit, the Forestry Commission, Cornwall Wildlife Trust, the Countryside Commission, English Heritage, the Environment Agency, the Farming and Wildlife Advisory Group and voluntary organisations
- industrial and commercial concerns such as the quarrying companies
- government bodies such as the Ministry of Defence and the Ministry of Agriculture, Fisheries and Food
- local authorities and parish councils
- research organisations such as universities and other institutions which can help to increase our understanding of the Cornish Killas and Granites Natural Area

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Glossary

Biodiversity	The variety of life forms that we see around us. The term encompasses the whole range of mammals, birds, reptiles, amphibians, fish, insects and other invertebrates, plants, fungi and micro-organisms.
CNC site	Cornwall Nature Conservation (CNC) sites are non-statutory designations given by the Cornwall Wildlife Trust to areas of semi-natural habitat of at least county importance.
EC Habitats Directive	The short name for Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna. Habitats and species of international importance are listed on this directive. Its protective legislation is implemented by domestic legislation in the member states.
Geological Conservation Review	A comprehensive review by the Nature Conservancy Council of the key Earth heritage sites in Britain, completed in 1990.
Metapopulation	A set of local populations linked together through dispersal.
Nationally rare	Occurs in 15 or fewer 10km squares of the national grid.
Nationally scarce	Occurs in 16-100 10km squares of the national grid.
NNR	National Nature Reserves (NNRs) were established to protect the most important areas of wildlife habitat and geological formations in Britain and as places of scientific research.
Red Data Book	Flora and fauna which are rare in Britain are listed in the British Red Data Books.
RIGS	A RIGS is a Regionally Important Geological/ Geomorphological Site, a non-statutory designation.
SAC	Special Areas of Conservation (SACs) are sites of European importance for nature conservation, designated under the EC Habitats Directive.
SSSI	Sites of Special Scientific Interest (SSSIs) are statutory designated sites where features of nature conservation importance are at their best and/or most concentrated. They include geological interest as well as flora and fauna. SSSIs are designated by English Nature and protected under the Wildlife and Countryside Act 1981 (as amended).

Appendices

1. **Relationship between the different nomenclatures for habitat types**
2. **Key species of the Cornish Killas and Granites Natural Area**

Appendix 1 Relationship between the different nomenclatures for habitat types

Cornish Killas and Granites habitat type	UK Biodiversity broad habitat type	UK Biodiversity costed/ proposed costed (P) habitat type	Phase 1 habitat type	National Vegetation Classification
Mixed farmland	Arable Improved grassland	Cereal field margins	B4 Improved grassland B6 Poor semi-improved grassland J1 Cultivated/disturbed land	MG6,7
Cornish hedges	Boundary features	Ancient and/or species rich hedgerows	B2 Boundaries	-
Lowland heathland	Lowland heathland	Lowland heathland	D1 Dry dwarf shrub heath D2 Wet dwarf shrub heath D3 Lichen/bryophyte heath D5 Dry heath/acid grassland mosaic D6 Wet heath/acid grassland mosaic	H4,7,8 M15,16
Mire	Fens, carr, marsh, swamp and reedbed Grazing marsh	Purple moor grass and rush pasture Fens	B5 Marsh/marshy grassland E1 Bog E2 Flush and spring E3 Fen F1 Swamp	M5,6,10,14,15,16,21,23,25,28,29 MG6,7,8,13 S4,12,20,27
Willow and alder carr	Fens, carr, marsh, swamp and reedbed		A1 Woodland A2 Scrub	W1,4,5,6,7
Unimproved grassland	Unimproved neutral grassland Acid grassland	Lowland hay meadow (P) Lowland dry acid grassland (P)	B1 Acid grassland B2 Neutral grassland	MG1,5,8,10 U3,4
Broadleaved woodland	Broadleaved and yew woodland	Upland oakwood? Wet woodlands (P)	A1 Woodland	W6,7,8,10,11,16,17
Mixed and coniferous woodlands	Planted coniferous woodland		A1 Woodland	-

Appendix 1. Relationship between the different nomenclatures for habitat types (cont.)

Rivers and streams	Rivers and streams		F2 Marginal and inundation G2 Running water	-
Mines and derelict land			I2 Artificial exposures and waste tips	-
Standing open water	Standing open water	Mesotrophic lakes Eutrophic standing waters (P)	G1 Standing water	-
Scrub			A2 Scrub	W1,22,23,24,25
Parkland	Lowland wood pastures and parkland	Lowland wood pastures and parkland (P)	A3 Parkland and scattered trees	-
Quarries			I2 Artificial exposures and waste tips	-
Coastal habitats	--- Refer to Maritime Natural Area Profiles ---			

Appendix 2 Key Species of the Cornish Killas and Granites Natural Area

The following is a list of species recorded since 1950, excluding those which are now known to be extinct in the area, thought to be "key". Refer to Section 5 for key species selection criteria and extinct species.

UK Biodiversity long list: S = short list, M = middle list, L = long list

RDB/threatened species: RDB1 = endangered, RDB2 = vulnerable, RDB3 = rare, RDBK = insufficiently known (using original IUCN Red List categories); CR = critically endangered, EN = endangered, VU = vulnerable (using 1994 IUCN Red List categories); p = proposed RDB status; BI = breeding in internationally significant numbers, WI = non-breeding in internationally significant numbers, BR = rare breeder, BD = declining breeder, BL = localised breeder, WL = localised non-breeder, SC = special category (using Batten *et al* (1990) criteria for birds)

EC Directive: I = Birds Directive Annex I; II = Habitats Directive Annex II; IV = Habitats Directive Annex IV

Wildlife & Countryside Act: 1 = Schedule 1; 5 = Schedule 5; 5* = Schedule 5, protection against sale only; 8 = Schedule 8

? = insufficiently known

Latin name	English name	UK Endemic	UK Bio-diversity long list	Declining rapidly in GB	RDB/threatened species	Character-istic species	EC Directive	Wildlife & Countryside Act
Fungi								
<i>Hericium erinaceus</i>	Hedgehog fungus		L		EN			
<i>Hygrocybe spadicea</i>	a wax cap		L	*	VU			
Lichens								
<i>Arthonia astroidestra</i>	a lichen				RDB3			
<i>Blarneya hibernica</i>	a lichen				RDB3			
<i>Graphina pauciloculata</i>	a lichen	*	M		VU			
<i>Lecanactis amyloea</i>	a lichen				RDB2			
<i>Leptogium cochleatum</i>	a lichen		L		RDB3			
<i>Lobaria amplissima</i>	a lichen		L	*				
<i>Parmelia minarum</i>	New Forest parmelia		L		VU			8
<i>Physcia tribacioides</i>	Southern grey physcia		L	*	EN			8
<i>Teloschistes flavicans</i>	Golden-hair lichen		L	*	VU			8
<i>Usnea articulata</i>	Sausage lichen					*		
Bryophytes								
<i>Amblystegium saxatile</i>	a moss				RDB2			

Appendix 2. Key Species of the Cornish Killas and Granites Natural Area (cont.)

Latin name	English name	UK Endemic	UK Bio-diversity long list	Declining rapidly in GB	RDB/ threatened species	Character-istic species	EC Directive	Wildlife & Country side Act
<i>Cryphaea lamyana</i>	Multi-fruited river moss		M		VU			8
<i>Ditrichum subulatum</i>	a moss				RDB3			
<i>Ephemerum sessile</i>	a moss		L	*				
<i>Fissidens algarvicus</i>	a moss				RDB3			
<i>Fontinalis squamosa</i> var. <i>curnowii</i>	a moss				RDB3			
<i>Funaria pulchella</i>	a moss				RDB3			
<i>Grimmia decipiens</i>	a moss			*				
<i>Grimmia laevigata</i>	a moss			*				
<i>Pohlia andalusica</i>	a moss				RDB3			
<i>Pottia wilsonii</i>	a moss			*				
<i>Scopelophila cataractae</i>	a moss				RDB2			
<i>Tortula cuneifolia</i>	a moss				RDB2			
<i>Weissia multicapsularis</i>	a moss		S	*	VU			
<i>Cephaloziella calyculata</i>	a liverwort				RDB3			
<i>Cephaloziella integerrima</i>	a liverwort				RDB2			
<i>Cephaloziella massalongi</i>	a liverwort				RDB2			
<i>Cephaloziella nicholsonii</i>	a liverwort	*	M		RDB3			
<i>Dumortiera hirsuta</i>	a liverwort				RDB3			
<i>Fossombronia pusilla</i> var. <i>maritima</i>	a liverwort				RDB3			
<i>Jamesoniella undulifolia</i>	Marsh earwort		S	*	EN			8
<i>Jungermannia caespiticia</i>	a liverwort				RDB3			
<i>Marsupella profunda</i>	Western rustwort		S	*	CR		II	8
<i>Petallophyllum ralfsii</i>	Petalwort		S	*			II	8
<i>Riccia rhenana</i>	a liverwort				RDB3			
<i>Scapania curta</i>	a liverwort				RDB3			
<i>Southbya tophacea</i>	a liverwort				RDB3			
Pteridophytes								
<i>Lycopodiella inundata</i>	Marsh clubmoss		M	*				
<i>Osmunda regalis</i>	Royal fern					*		
<i>Pilularia globulifera</i>	Pillwort		L					
<i>Trichomanes speciosum</i>	Killamey fern		S		VU		II, IV	8

Appendix 2. Key Species of the Cornish Killas and Granites Natural Area (cont.)

Latin name	English name	UK Endemic	UK Bio-diversity long list	Declining rapidly in GB	RDB/threatened species	Characteristic species	EC Directive	Wildlife & Countryside Act
Flowering plants								
<i>Agrostemma githago</i>	Comcockle				RDB1			
<i>Centaurea cyanus</i>	Cornflower		M	*				
<i>Chamaemelum nobile</i>	Chamomile		L	*				
<i>Chenopodium vulvaria</i>	Stinking goosefoot		L	*	VU			8
<i>Cicendia filiformis</i>	Yellow centaury			*				
<i>Cynodon dactylon</i>	Bermuda-grass				RDB3			
<i>Dianthus armeria</i>	Deptford pink		M	*				
<i>Erica ciliaris</i>	Dorset heath		L		RDB3			
<i>Erica vagans</i>	Cornish heath				RDB3			
<i>Eryngium campestre</i>	Field eryngo		L		VU			8
<i>Euphorbia hyberna</i>	Irish spurge				RDB3			
<i>Euphrasia vigursii</i>	Vigur's eyebright	*	S		RDB3			
<i>Filago pyramidata</i>	Broad-leaved cudweed		M	*	EN			8
<i>Fumaria occidentalis</i>	Western ramping-fumitory	*	S		VU			
<i>Fumaria purpurea</i>	Purple ramping-fumitory		M					
<i>Fumaria reuteri</i>	Martin's ramping-fumitory		L	*	EN			8
<i>Gastridium ventricosum</i>	Nit-grass				RDB2			
<i>Geranium purpureum</i> ssp. <i>forsteri</i>	a crane's-bill				RDB1			
<i>Geranium purpureum</i> ssp. <i>purpureum</i>	Little-robin				RDB2			
<i>Hammarbya paludosa</i>	Bog orchid		L	*				
<i>Hyacinthoides non-scripta</i>	Bluebell					*		
<i>Hypericum linariifolium</i>	Toadflax-leaved St. John's-wort				RDB2			
<i>Hypericum undulatum</i>	Wavy St John's-wort			*		*		
<i>Hypochaeris maculata</i>	Spotted cat's-ear		L					8
<i>Illecebrum verticillatum</i>	Coral necklace			*				
<i>Lavatera cretica</i>	Smaller tree-mallow				RDB3			
<i>Lobelia urens</i>	Heath lobelia		L	*	VU			
<i>Lotus angustissimus</i>	Slender bird's-foot trefoil		L		RDB3			
<i>Orchis mascula</i>	Early purple orchid					*		
<i>Orobanche rapum-genistae</i>	Greater broomrape		L	*				
<i>Physospermum cornubiense</i>	Cornish bladderseed		L		VU			
<i>Polycarpon tetraphyllum</i>	Four-leaved allseed				RDB3			

Appendix 2. Key Species of the Cornish Killas and Granites Natural Area (cont.)

Latin name	English name	UK Endemic	UK Bio-diversity long list	Declining rapidly in GB	RDB/ threatened species	Characteristic species	EC Directive	Wildlife & Countryside Act
<i>Primula vulgaris</i>	Primrose					*		
<i>Pyrus cordata</i>	Plymouth pear		L		EN			8
<i>Ranunculus tripartitus</i>	Three-lobed crow foot		S	*	RDB3			
<i>Scrophularia scorodonia</i>	Balm-leaved figwort							
<i>Sibthorpia europaea</i>	Cornish moneywort					*		
<i>Ulex gallii</i>	Western gorse		L			*		
<i>Viola lactea</i>	Pale dog-violet			*				
Insects								
<i>Ceriagrion tenellum</i>	Small red damselfly			?				
<i>Cordulegaster boltonii</i>	Golden-ringed dragon fly					*		
<i>Ischnura pumilio</i>	Scarce blue-tailed damsel fly			?				
<i>Platynemesis pennipes</i>	White-legged damsel fly			?				
<i>Metrioptera brachyptera</i>	Bog bush-cricket			?				
<i>Halticus macrocephalus</i>	a plantbug				RDB1			
<i>Lasiacantha capucina</i>	a lacebug				pRDB3			
<i>Physatocheila smreczynskii</i>	a lacebug			?				
<i>Agabus biguttatus</i>	a water beetle			?				
<i>Agabus brunneus</i>	a water beetle		M	*	RDB2			
<i>Amara fulva</i>	a ground beetle			*				
<i>Anchonidium unguiculare</i>	a weevil				RDB2			
<i>Ceutorhynchus geographicus</i>	a weevil			?				
<i>Ceutorhynchus pilosellus</i>	a weevil				RDB2			
<i>Chlaenius nigricornis</i>	a ground beetle			?				
<i>Cicindela hybrida</i>	a ground beetle		M	*	pRDB2			
<i>Conopalpus testaceus</i>	a false darkling beetle			?				
<i>Deronectes latus</i>	a water beetle			?				
<i>Dirhagus pygmaeus</i>	a false click beetle			?	RDB3			
<i>Dytiscus dimidiatus</i>	a water beetle				pRDB3			
<i>Elaphrus uliginosus</i>	a ground beetle			?				
<i>Hydrochus nitidicollis</i>	a scavenger water beetle		M	*	RDB3			
<i>Ilybius guttiger</i>	a water beetle			?				
<i>Lucanus cervus</i>	Stag beetle		S				II	
<i>Malthinus balteatus</i>	a soldier beetle			?				

Appendix 2. Key Species of the Cornish Killas and Granites Natural Area (cont.)

Latin name	English name	UK Endemic	UK Bio-diversity long list	Declining rapidly in GB	RDB/ threatened species	Characteristic species	EC Directive	Wildlife & Countryside Act
<i>Quedius xanthopus</i>	a rove beetle			?				
<i>Rhantus grapii</i>	a water beetle			?				
<i>Rhizophagus nitidulus</i>	a narrow dark beetle			?				
<i>Sibinia arenariae</i>	a weevil			?				
<i>Thymalus limbatus</i>	a domed fungus beetle			?				
<i>Acleris umbrana</i>	a tortrix moth				pRDB1			
<i>Alcis jubata</i>	Dotted carpet			?				
<i>Apomyelois bistriatella neophanes</i>	a pyralid moth			?				
<i>Archana sparganii</i>	Webb's wainscot			?				
<i>Argolamprotes micella</i>	a micro-moth				pRDB3			
<i>Argynnis adippe</i>	High brown fritillary		S	*	RDB2			5
<i>Biselachista eleochariella</i>	a micro-moth			?				
<i>Boloria euphrosyne</i>	Pearl bordered fritillary		S	*				5*
<i>Cosmia diffinis</i>	White-spotted pinion		M	*				
<i>Discoloxia blomeri</i>	Blomer's rivulet			?				
<i>Eilema sororcula</i>	Orange footman		L	*				
<i>Epischnia banksiella</i>	a pyralid moth		L					
<i>Eupithecia expallidata</i>	Bleached pug			?				
<i>Eupithecia irriguata</i>	Marbled pug			?				
<i>Eurodryas aurinia</i>	Marsh fritillary		S	*			II	5*
<i>Eurrhynx terrealis</i>	a pyralid moth				pRDB3			
<i>Hemaris tityus</i>	Narrow-bordered bee hawk		M	*				
<i>Heterogenea asella</i>	Triangle		L		RDB3			
<i>Hydrelia sylvata</i>	Waved carpet		M	*				
<i>Hypena rostralis</i>	Buttoned snout		M	*				
<i>Idaea degeneraria</i>	Portland ribbon wave		L	*	RDB3			
<i>Idaea dilutaria</i>	Silky wave		M	*	RDB3			
<i>Jodia croceago</i>	Orange upperwing		M	*	RDB3			
<i>Leptidea sinapis</i>	Wood white		L	*				5*
<i>Mellicta athalia</i>	Heath fritillary		S	*	RDB2			5
<i>Metzneria aestivella</i>	a micro-moth			?				
<i>Microthrix similella</i>	a pyralid moth			?				
<i>Moma alpium</i>	Scarce merveille du jour		M	*	RDB3			

Appendix 2. Key Species of the Cornish Killas and Granites Natural Area (cont.)

Latin name	English name	UK Endemic	UK Bio-diversity long list	Declining rapidly in GB	RDB/ threatened species	Character-istic species	EC Directive	Wildlife & Countryside Act
<i>Monochroa lucidella</i>	a micro-moth			?				
<i>Mythimna turca</i>	Double line			?				
<i>Nothris congressariella</i>	a micro-moth				pRDB1			
<i>Paracystola acroxantha</i>	a micro-moth				pRDB3			
<i>Phlyctaenia stachydalis</i>	a pyralid moth				pRDBK			
<i>Phyllonorycter staintonella</i>	a micro-moth				pRDB1			
<i>Plebejus argus</i>	Silver studded blue		M	*				5*
<i>Schrankia taenialis</i>	White lined snout		M	*				
<i>Strymonidia w-album</i>	White letter hairstreak			?				
<i>Synanthedon tipuliformis</i>	Currant clearwing			*				
<i>Tetheella fluctuosa</i>	Satin lutestring			?				
<i>Asilus crabroniformis</i>	a robber fly		S	*				
<i>Beris clavipes</i>	a soldier fly			?				
<i>Beris fuscipes</i>	a soldier fly			?				
<i>Chrysotoxum elegans</i>	a hoverfly				RDB3			
<i>Chrysotus verralli</i>	a dolichopodid fly				pRDB3			
<i>Dolichopus signifer</i>	a dolichopodid fly			?				
<i>Erycia furibunda</i>	a parasitic fly				RDB2			
<i>Eurina lurida</i>	a fly				pRDB3			
<i>Mallota cimbiciformis</i>	a hoverfly			?				
<i>Myopa polystigma</i>	a fly				pRDB3			
<i>Oxycera morrisii</i>	a soldier fly			?				
<i>Tetanocera phyllophora</i>	a snail-killing fly			?				
<i>Xylota xanthocnema</i>	a hoverfly			?				
<i>Ancistrocerus antilope</i>	a mason wasp				RDB3			
<i>Andrena alfkanella</i>	a solitary bee				RDB3			
<i>Aporus unicolor</i>	a spider-hunting wasp			*				
<i>Bombus sylvarum</i>	Shrill carder bee		S					
<i>Cryptocheilus notatus</i>	a spider-hunting wasp				RDB2			
<i>Dasygaster altercator</i>	Hairy legged mining bee			*				
<i>Eucera longicornis</i>	a nomad bee			*				
<i>Halictus maculatus</i>	a solitary bee				RDB1			
<i>Podalonia hirsuta</i>	Hairy sand wasp			*				

Appendix 2. Key Species of the Cornish Killas and Granites Natural Area (cont.)

Latin name	English name	UK Endemic	UK Bio-diversity long list	Declining rapidly in GB	RDB/ threatened species	Character-istic species	EC Directive	Wildlife & Countryside Act
Spiders								
<i>Araneus angulatus</i>	an orb-weaver spider			?				
<i>Centromerus serratus</i>	a money spider			?				
Molluscs								
<i>Lymnaea glabra</i>	a pond snail		L	*	RDB2			
Other invertebrates								
<i>Chirocephalus diaphanus</i>	Fairy shrimp		L	?	RDB2			5
<i>Chordeuma sylvestre</i>	a millipede		L		RDBK			
Fish								
<i>Anguilla anguilla</i>	Eel					*		
<i>Cottus gobio</i>	Bullhead		L				II	
<i>Lampetra fluviatilis</i>	River lamprey		L				II	
<i>Lampetra planeri</i>	Brook lamprey		L				II	
<i>Osmerus eperlanus</i>	Cucumber smelt		L					
<i>Petromyzon marinus</i>	Sea lamprey		L				II	
<i>Salmo salar</i>	Atlantic salmon		L	*			II	
<i>Salmo trutta</i>	Brown/sea trout					*		
<i>Thymallus thymallus</i>	Grayling		L					
Amphibians								
<i>Bufo bufo</i>	Common toad		L					5*
<i>Rana temporaria</i>	Common frog		L					5*
<i>Triturus helveticus</i>	Palmate newt		L					5*
Reptiles								
<i>Anguis fragilis</i>	Slow worm		L	?				5
<i>Lacerta agilis</i>	Sand lizard		S				IV	5
<i>Lacerta vivipara</i>	Common lizard					*		
<i>Natrix natrix</i>	Grass snake		L	?				5
<i>Vipera berus</i>	Adder		L	?		*		5
Birds								
<i>Accipiter nisus</i>	Sparrowhawk		L					
<i>Acrocephalus paludicola</i>	Aquatic warbler		S				I	

Appendix 2. Key Species of the Cornish Killas and Granites Natural Area (cont.)

Latin name	English name	UK Endemic	UK Bio-diversity long list	Declining rapidly in GB	RDB/ threatened species	Characteristic species	EC Directive	Wildlife & Countryside Act
<i>Acrocephalus schoenabanus</i>	Sedge warbler		L					
<i>Acrocephalus scirpaceus</i>	Reed warbler		L					
<i>Alauda arvensis</i>	Skylark		S	*		*		
<i>Alcedo atthis</i>	Kingfisher		L				I	1
<i>Anas crecca</i>	Teal		L		WI			
<i>Anas penelope</i>	Wigeon		L		WI,WL			
<i>Anas platyrhynchos</i>	Mallard		L					
<i>Anas strepera</i>	Gadwall		L		WI,WL			
<i>Anthus pratensis</i>	Meadow pipit		L					
<i>Anthus trivialis</i>	Tree pipit		L					
<i>Aythya ferina</i>	Pochard		L		WI,BR			
<i>Aythya fuligula</i>	Tufted duck		L					
<i>Botaurus stellaris</i>	Bittern		S		BR,BD,BL		I	1
<i>Buteo buteo</i>	Buzzard		L			*		
<i>Caprimulgus europaeus</i>	Nightjar		M	*	SC		I	
<i>Carduelis cannabina</i>	Linnet		M	*				
<i>Carduelis carduelis</i>	Goldfinch		L	*				
<i>Carduelis chloris</i>	Green finch		L					
<i>Certhia familiaris</i>	Treecreeper		L					
<i>Cettia cettia</i>	Cetti's warbler		L		BR			1
<i>Cinclus cinclus</i>	Dipper		L					
<i>Circus cyaneus</i>	Hen harrier		L		SC		I	1
<i>Circus pygargus</i>	Montagu's harrier		L		BR		I	1
<i>Corvus corax</i>	Raven					*		
<i>Coturnix coturnix</i>	Quail		L		BR			1
<i>Delichon urbica</i>	House martin		L					
<i>Dendrocopus major</i>	Great spotted woodpecker		L					
<i>Dendrocopus minor</i>	Lesser spotted woodpecker		L					
<i>Egretta garzetta</i>	Little egret		L				I	
<i>Emberiza cirrus</i>	Cirl bunting		M	*	BR,BD,BL,WL			1
<i>Emberiza citrinella</i>	Yellowhammer		L					
<i>Emberiza schoeniclus</i>	Reed bunting		M	*				
<i>Falco columbarius</i>	Merlin		L		SC		I	1

Appendix 2. Key Species of the Cornish Killas and Granites Natural Area (cont.)

Latin name	English name	UK Endemic	UK Bio-diversity long list	Declining rapidly in GB	RDB/ threatened species	Character-istic species	EC Directive	Wildlife & Countryside Act
<i>Falco peregrinus</i>	Peregrine		L		BI		I	1
<i>Falco subbuteo</i>	Hobby		L					1
<i>Falco tinnunculus</i>	Kestrel		L	*				
<i>Ficedula hypoleuca</i>	Pied flycatcher		L					
<i>Gallinago gallinago</i>	Snipe		L					
<i>Hirundo rustica</i>	Swallow		L	*				
<i>Locustella naevia</i>	Grasshopper warbler		L	*				
<i>Lullula arborea</i>	Woodlark		M	*	BR		I	1
<i>Lymnocyptes minimus</i>	Jack snipe		L					
<i>Miliaria calandra</i>	Com bunting		M	*				
<i>Motacilla alba</i>	Pied wagtail		L					
<i>Motacilla cinerea</i>	Grey wagtail		L					
<i>Muscicapa striata</i>	Spotted flycatcher		M	*				
<i>Parus ater</i>	Coal tit		L					
<i>Parus caeruleus</i>	Blue tit		L					
<i>Parus major</i>	Great tit		L					
<i>Parus montanus</i>	Willow tit		L					
<i>Parus palustris</i>	Marsh tit		L	*				
<i>Perdix perdix</i>	Grey partridge		S	*	BD			
<i>Phoenicurus phoenicurus</i>	Redstart		L					
<i>Phylloscopus collybita</i>	Chiffchaff		L					
<i>Phylloscopus sibilatrix</i>	Wood warbler		L					
<i>Phylloscopus trochilus</i>	Willow warbler		L					
<i>Picus viridis</i>	Green woodpecker		L					
<i>Pluvialis apricaria</i>	Golden plover		L		WI,SC		I	
<i>Prunella modularis</i>	Dunnock		L	*				
<i>Pyrrhula pyrrhula</i>	Bullfinch		M	*				
<i>Rallus aquaticus</i>	Water rail		L					
<i>Regulus regulus</i>	Goldcrest		L					
<i>Riparia riparia</i>	Sand martin		L					
<i>Saxicola torquata</i>	Stonechat		L			*		
<i>Scolopax rusticola</i>	Woodcock		L	*				
<i>Sitta europaea</i>	Nuthatch		L					

Appendix 2. Key Species of the Cornish Killas and Granites Natural Area (cont.)

Latin name	English name	UK Endemic	UK Bio-diversity long list	Declining rapidly in GB	RDB/ threatened species	Character-istic species	EC Directive	Wildlife & Countryside Act
<i>Strix aluco</i>	Tawny owl		L					
<i>Sylvia atricapilla</i>	Blackcap		L					
<i>Sylvia borin</i>	Garden warbler		L					
<i>Sylvia communis</i>	Whitethroat		L					
<i>Sylvia undata</i>	Dartford warbler		L		BR,BL		I	1
<i>Turdus philomelos</i>	Song thrush		S	*				
<i>Tyto alba</i>	Barn owl		L	*	SC	*		1
<i>Vanellus vanellus</i>	Lapwing		L	*				
Mammals								
<i>Arvicola terrestris</i>	Water vole		S	*				
<i>Barbastellus barbastellus</i>	Barbastelle		L				II, IV	5
<i>Dama dama</i>	Fallow deer		L					
<i>Lepus europaeus</i>	Brown hare		S	*				
<i>Lutra lutra</i>	European otter		S			*	II, IV	5
<i>Meles meles</i>	Badger		L			*		
<i>Muscardinus avellanarius</i>	Common dormouse		S	*			IV	5
<i>Mustela erminea</i>	Stoat		L					
<i>Mustela nivalis</i>	Weasel		L	*				
<i>Myotis brandti</i>	Brandt's bat		L				IV	5
<i>Myotis daubentoni</i>	Daubenton's bat		L				IV	5
<i>Myotis mystacinus</i>	Whiskered bat		L				IV	5
<i>Myotis nattereri</i>	Natterer's bat		L				IV	5
<i>Neomys fodiens</i>	Water shrew		L					
<i>Nyctalus noctula</i>	Noctule		L	*			IV	5
<i>Pipistrellus pipistrellus</i>	Pipistrelle		S	*			IV	5
<i>Plecotus auritus</i>	Brown long-eared bat		L	*			IV	5
<i>Rhinolophus ferrumequinum</i>	Greater horseshoe bat		S	*		*	II, IV	5
<i>Rhinolophus hipposideros</i>	Lesser horseshoe bat		L			*	II, IV	5
<i>Sorex araneus</i>	Common shrew		L					
<i>Sorex minutus</i>	Pygmy shrew		L					