



Limestone Pavement

Limestone pavement was formed during the last Ice Age by glaciers moving over the areas of limestone rock and scouring their surface. Subsequent erosion of fissures in the rock by rain and groundwater formed the pattern of clints and grikes we see today.

Current status

Limestone pavements were formed when the landscape was subjected to intense glacial scouring during the last Ice Age, exposing the limestones in the platforms we see today. Since then, erosion has continued, with acids in rainwater and groundwater forming a complex pattern of fissures known as grikes, between massive blocks of limestone known as clints. The considerable diversity of appearance of limestone pavements found in different areas reflects not only the composition and structure of the bedrock but also the directions of the ice movements.

Limestone pavement is a globally rare habitat, a significant proportion of which lies within Cumbria. Surveys by Ward and Evans (1976) and English Nature (1995) recorded 1052 ha of pavement in Cumbria, some 36% of the total resource of this habitat in Britain. The remainder is mainly in Yorkshire, Lancashire, Scotland and Wales. In terms of losses, a recent assessment of the national picture (of which Cumbria is representative) showed that of the 537 pavements looked at, only 3% were undamaged, and that over 40% of the

British resource of limestone pavement has been wholly destroyed. Limestone pavement is, once lost or damaged, non-renewable.

Limestone pavement is very localised in its distribution. In Cumbria, limestone pavement is most extensive in a ring around Morecambe Bay and on the limestone fells between Shap and Kirkby Stephen, within the Cumbria Fells and Dales Natural Area. Smaller areas are found on the high western edge of the Pennines, within the North Pennines Natural Area and there are a few isolated areas on the northern edge of the Lake District.

All significant areas of limestone pavement are protected by Limestone Pavement Orders. There are 4 National Nature Reserves supporting limestone pavement in Cumbria. 12 Sites of Special Scientific Interest are notified for their limestone pavements. Limestone pavements are identified in Annex 1 of the EC Habitats Directive as a priority habitat and will form part of the Natura 2000 Network. In Cumbria, 10 SSSIs fall within 2 candidate Special Areas of Conservation for this habitat. Some 70% of Cumbrian pavements are protected by SSSI and SAC designations.

Characteristic wildlife

Limestone pavements usually exist as part of a mosaic of habitats which may include woodland, scrub, heathland, limestone grassland and other habitats. Having said this, limestone pavements may be split broadly into three types: open, wooded and scrubby. Open pavements consist of bare clints with vegetation confined to the grikes in between, although scattered trees may occur. Wooded pavement has a more or less continuous tree cover, with ground vegetation, including mosses over the surface of the clints. Scrubby pavement forms a continuum between open and wooded pavement types.

Flowering plants, mosses and lichens are often abundant, and differ according to aspect, altitude and the degree of shade afforded by nearby trees and shrubs. Limestone pavements often contain unusual combinations of plants, with species more usually associated with woodland and wood edges thriving in shaded grikes alongside plants of more open environments. Some of the most typical plants of grikes include herb Robert, dog's mercury, wall lettuce, brittle bladder-fern, male fern, wood sorrel, ivy and hart's-tongue fern.

Limestone pavements provide a suitable habitat for a wide range of invertebrates, which thrive in the warm and sheltered microclimate that the pavements provide.

Key species

The following rare or threatened species are associated with limestone pavements in Cumbria. Species were selected on the basis that they are UK BAP Priority Species (marked P) or species of County importance in Cumbria. Where species of County importance are also UK BAP Species of Conservation Concern, they are marked C.

a wood ant	<i>Formica lugubris</i>	P
a mason bee	<i>Osmia parietina</i>	P
high brown fritillary	<i>Argynnis adippe</i>	P
northern brown argus	<i>Aricia artaxerxes</i>	P
pearl bordered fritillary	<i>Boloria euphrosyne</i>	P
a woodlouse	<i>Armadillidium pictum</i>	C
a midge	<i>Dasyhelea lithotelmatica</i>	C
a crystal snail	<i>Vitrea subrimata</i>	
cistus forester	<i>Adscita geryon</i>	
least minor	<i>Photedes captiuncula</i>	C

a lichen	<i>Syalissa symphorea</i>	
juniper	<i>Juniperus communis</i>	P
Lancastrian whitebeam	<i>Sorbus lancastricensis</i>	*

*=Species endemic to United Kingdom

Best management practice

The particular management regime for any one site will need to take account of local circumstances.

General good management practice for all types of pavement

- avoid all fertiliser application on or around open pavement
- avoid the use of asulam herbicide for bracken control - this will kill rare ferns which live in the grikes
- avoid supplementary feeding of stock on limestone pavement
- graze appropriate stock at a suitable stocking level, according to the type of pavement
- control rabbit populations

Management for open pavement

- Restoration management: Rehabilitation of heavily grazed pavement may require a major reduction in stocking rate, or total removal of grazing animals, for a period of five to ten years.
- Maintaining open pavement: The optimum long term stocking level to maintain the conservation interest of open pavement is less than one ewe per hectare (or cattle equivalent based on 5 ewes=1 cow).

Management for wooded pavement

- Maintain coppice and other woodland management. Reintroduce where it had lapsed. Coppicing may enhance the conservation value; maintaining areas of high forest within a site will provide diversity.
- Juniper and yew should be retained and maintained. Non-native species such as some conifers, beech and self-sown sycamore should be removed.
- Deer control and fencing of coppice regrowth may be required in some areas.

Management for scrubby pavement

- Invasive species such as blackthorn, cotoneaster, gorse or bramble should be removed where they shade out other flora.

- If woodland cover is encroaching, coppice management should be considered.

Current issues

- Overall, management issues, especially grazing levels on open pavement, are of over-riding importance to the habitat in Cumbria, although direct removal/damage is still an issue.
- Illegal removal of stone for garden rockeries and municipal landscaping. Enforcement of the current legislation relating to limestone pavement removal is difficult, as an offender currently needs to be “caught in the act” to be prosecuted. Garden centres continue to sell ‘water-worn limestone’ as there is still a demand from the public; relative lack of public awareness of its ecological importance perpetuates the demand
- Destruction of pavement as an incidental result of legal limestone quarrying at sites adjacent to areas of pavement
- Inappropriate grazing is a problem characteristic of open sites in Cumbria, where high densities of stock can remove or deplete the characteristic flora within grikes. Problems may be exacerbated by a high rabbit population
- Cessation of management on wooded pavement, leading to lack of structural diversity
- In-filling of grikes to remove perceived threat of injury to grazing animals.

Current action

- Sites are owned and appropriately managed by a variety of conservation organisations.
- A campaign for the protection of limestone pavement nationally is based in the County, co-ordinated by Cumbria Wildlife Trust and has a number of other partners.
- Complete coverage of the habitat in the County by Limestone Pavement Orders (LPOs). LPOs are made by Local Authorities under Section 34 of the Wildlife and Countryside Act. Removal of pavement within an order area is a criminal offence.
- Cumbria County Council's Mineral and Waste Local Plan contains the policy (Policy 50): “Planning permission will not be granted for mineral and waste development which would adversely affect limestone pavement”.
- The Countryside Stewardship agri-environment scheme currently targets limestone pavements on

the Orton Fells and around Morecambe Bay, by providing financial incentives to landowners and farmers to, for example, control scrub and maintain sympathetic grazing regimes. The Lake District Environmentally Sensitive Area scheme covers some limestone pavements areas and offers similar benefits to Countryside Stewardship.

- Action by Forest Enterprise to remove conifers and other non-native trees previously planted on limestone pavement.
- Limestone pavement management booklet has been prepared to give guidance on optimal management of pavement.

Context in relation to other plans:

UK Habitat Action Plans

There is a UK Biodiversity Action Plan for limestone pavement in *Biodiversity: the UK Steering Group Report* (1995), which sets the following UK objectives and targets:

- Ensure that there is no further loss to the extent and quality of limestone pavement areas.
- Maintain the balance between features of geological importance and a characteristic assemblage of native plant species.

National Lead Agency

The national lead agency for limestone pavement is Countryside Agency, whose nominated officer is based at their Cheltenham office.

Local contacts

For all aspects : Limestone Pavement Action Group - Sarah Wiseman (015394 48280) or Simon Webb (01539 792800)

For aspects of enforcement of planning law: Cumbria County Council (01539 773407)

Associated plans in the Cumbria BAP

The following Cumbria species/habitat action plans are of relevance to limestone pavements:

Phase I

- upland mixed ash woodland
- calcareous grassland
- high brown fritillary
- pearl bordered fritillary
- juniper

Phase II

- least minor moth
- northern hawk's-beard

References

- Limestone Pavement Action Group (1998) *Limestone Pavement: Our Fragile Heritage* (booklet).
- Ward, S.D. and Evans, D.F. (1976) Conservation Assessment of British limestone pavements based on floristic criteria. *Biological Conservation* **9**, 217-233.
- Webb, S. (1995) Conservation of limestone pavements. *Transactions of British Cave Research Association* **21**, 97-100.

Objectives, targets and proposed actions for limestone pavements in Cumbria

Broad Objective A	Ensure no further loss of limestone pavement in Cumbria			
Operational Objective	Action Required	Suggested organisational involvement	Time-scale	Type
I Ensure that planning and legislation systems protect limestone pavement	1 Seek to ensure that no new planning permissions (or extensions to existing ones) are granted which result in the loss of or damage to limestone pavements.	LAs, LPAG	O	SS
	2 Lobby DETR to improve legislative protection for pavements. Press case for a trade ban by 2003 and for more enforceable LPO legislation by 2005.	LPAG	M	PL
	3 Enforce existing LPO legislation and build links with Police Wildlife Officers to assist with enforcement. By 2001.	EN, CCC, LDNPA, YDNPA	S/O	PL
	4 Designate sites of national importance as SSSI by 2002.	EN	M	SS
	5 Designate as SACs all limestone pavements which meet selection criteria, by 2004.	DETR, EN	M	SS
	6 Identify as Wildlife Sites the most important areas for wildlife in the County outside of statutory sites, including areas of limestone pavement, by 2006.	CWT, LAs	L	SS

Broad Objective B	Ensure the favourable condition of all sites			
Operational Objective	Action Required	Suggested organisational involvement	Time-scale	Type
1 Achieve appropriate management for both ecological and geological objectives of limestone pavement. 70% to be in appropriate management by 2005, and 90% by 2010	1 Seek to bring 100ha of previously unmanaged pavement woodlands into Woodland Grant Scheme by 2005.	FC, FWAG, CFL, ECCP	M	SS
	2 Where appropriate and desirable, restore limestone pavement to areas currently under conifer plantation, achieving removal of a further 300 ha of conifer plantation from limestone pavement by 2005.	FE	M	SS
	3 All SSSI limestone pavements to be in favourable management through, for example, Wildlife Enhancement Scheme or Reserve Enhancement Scheme agreements. By 2005.	EN	M	SS
	4 Ensure limestone pavement is considered in the setting up of new agri-environment agreements and in any revision of existing agreements to ensure that, where possible, the habitat is brought into favourable management.	MAFF, FWAG, CFL, ECCP	O	SS
	5 Continue to apply "cross-compliance" policy to upland vegetation, including limestone pavement, to help ensure that no Cumbrian pavement is ecologically over-grazed.	MAFF	O	SS
2 Foster increased awareness and understanding of the biological and geological importance of limestone pavement and how it can be protected and properly managed	1 Provide information and advice, via key organisations, to all appropriate landowners/managers on the importance and suitable management of limestone pavement (using, among other means, the Limestone Pavement Management booklet). By 2003.	LPAG, EN, MAFF, FWAG, ECCP, CLA, CWT	M	A/C P
	2 Continue to reduce the demand for 'water-worn limestone' by providing interpretation at appropriate limestone pavement nature reserves and major gardens containing decorative water-worn limestone, and through all appropriate media. By 2003.	LPAG, EN, CWT, NT	M	CP

Broad Objective B		Ensure the favourable condition of all sites		
Operational Objective	Action Required	Suggested organisational involvement	Time-scale	Type
	3 Inform all garden centres/retail outlets of the importance of limestone pavements by 2001, with a view to ending its sale by 2003.	LPAG	S/M	CP

Broad Objective C		Ensure the favourable condition of all sites		
Operational Objective	Action Required	Suggested organisational involvement	Time-scale	Type
I Monitor changes in the extent and quality of limestone pavement in Cumbria, so that an assessment can be made of the effectiveness of conservation action	1 Collate information on the quality and extent (including area in favourable management) of limestone pavement into an appropriate database, by 2001.	EN, CWT	S	RM
	2 Devise a strategy for monitoring the quality and extent of limestone pavement, by 2002.	EN, YDNPA, CWT	M	RM
	3 Implementation of the above strategy to be in place by 2002.	LPAG, EN, CWT	M	RM

Key to Tables

Suggested organisational involvement: Key Deliverers in bold type; Partners in plain type.

CCC = Cumbria County Council; CFL = Cumbria Farm Link; CLA = Country Landowners Association; CWT = Cumbria Wildlife Trust; ECCP = East Cumbria Countryside Project; DETR = Department of the Environment, Transport and the Regions; EN = English Nature; FC = Forestry Commission; FE = Forest Enterprise; FWAG = Farming and Wildlife Advisory Group; LAs = Local Authorities; LDNPA = Lake District National Park Authority; LPAG = Limestone Pavement Action Group; LPO = Limestone Pavement Order; MAFF = Ministry of Agriculture, Fisheries and Food; NT = National Trust.

Timescale: O=ongoing; S=short term (2000-2001); M=medium (2002-2005); L=long (2006-2010).

Type: Type of action; PL=Policy & Legislation; SS=Site Safeguard & Management; SP=Species Management and Protection (species plans only); A=Advisory; RM=Research & Monitoring; CP=Communications and Publicity.