Managing geodiversity

Introduction

Management of natural heritage requires a balance between the need to protect and enhance biodiversity or landscape character against the legitimate needs of local populations or visitors. Management planning for Geoconservation brings together all of the themes discussed in previous sections, drawing together assessments of value to science and society along with management needs to protect and also share this value. This integration of diverse components into a single vision of value and management needs is crucial to sustainable management of landscapes or sites.

In this section:

- the basic components of a management plan using a World Heritage site as an example;
- the role of action plans to focus on key issues, target setting and progress monitoring;
- dealing with specific management pressures – fossil collecting in a World Heritage site and managing visitors in a geopark;
- a Namibian geopark – the benefits of Geoconservation in an African context.

Management planning for geodiversity

Tony Weighell

Management planning to protect cultural heritage or biodiversity is commonplace and widely applied. Management of geological and geomorphological heritage at site or landscape scales is equally necessary but not so well understood and less frequently deployed.

Management Plans provide an agreed framework for sustainable management of a particular geological site, suite of sites or area of landscape which has recognised values. Such plans guide actions by decision making bodies operating at local, national or the international level.

Management Plan components

An effective management plan requires establishing partnerships between individuals, groups and organisations that have an interest in an area or site, and who have responsibility for making decisions. These groups will include local and national bodies, and in some cases (such as World Heritage designations) international institutions. Effective working across such diverse stakeholders requires a common understanding of the nature of the geological heritage to be managed and effective information sharing. A Management Plan can bridge gaps in understanding between diverse interest groups and bring them together with a common purpose built around common understanding, aims and recognition of potential benefits for all concerned.

Key components in a Management Plan will be:

- Recognition of key issues relating to the management area;
- Identification of the principles that will underpin the plan;
- Statement of management objectives to be pursued;
- Implementation strategy for the plan.

Key issues will be site or landscape specific, be dependent on the scientific and cultural values of the area concerned and the prevailing natural and human pressures on the site. In areas close to major population centres, or which act as tourist attractions, visitor related pressures may be critical. In other cases effects of industrial activity (mining or oil exploration) or infrastructure development (road, industrial facilities) may be the major issues. On sites important for fossils collection management may be important.

Identification of issues should lead to developing a set of principles that will determine how the issues will be addressed. The principles should include consideration of the conservation value of the area, the socio-economic interests, visitor management and the wider setting of the site and can lead directly to setting specific management objectives. The tabulation shows how the Giant's Causeway World Heritage site in Northern Ireland has developed this hierarchy linking issues, principles and objectives.

Planning is an essential prerequisite for management actions, but it must be effectively followed up by an implementation strategy which addresses the practical aspects of planning, in particular:

- Establishes a management structure to ensure responsibilities are assigned to individuals, groups or organisations;
- Ensures sufficient staffing within the management structure to undertake the work required;
- Identifies funding sources;
- Makes provision for monitoring of actions and results and also for periodic review of progress to allow revision of the plan as required.

Identifying Geoconservation value

Management planning for complex sites that include cultural, biological and geodiversity interest can be a challenge given the potential for conflicting management requirements in respect of the different heritage interests. Geoconservation issues may be overlooked or given inadequate attention in the absence of a full evaluation of the value of a site or landscape with adequate attention paid to geodiversity. Where sites/landscapes are already recognised of geodiversity interest this may be less of a problem with attention focussed on developing a management strategy for heritage values already well established in the minds of local communities. In other situations the geodiversity interest may need to be demonstrated through a geodiversity audit as part of regional evaluation in the context of a geodiversity action plan.

The Dorset–Devon World Heritage site is complex with a comprehensive management plan including a range of objectives:

- Conserve the geological interest of the site;
- Conserve and enhance the land- and sea-scape;
- Welcome local people and visitors at sustainable levels
- Encourage safe use of the site by educational groups of all ages
- Foster the gathering and dissemination of scientific information.

Components of the Giant's Causeway Management plan
Source: http://www.ehsni.gov.uk/pubs/publications/WHS_Summary_Leaflet.pdf

Example issues	Example principles	Example objectives
Conservation values	• Sustain and conserve the Outstanding Universal Value of the Site's geology and landscape for future generations. • Sustain and conserve the ecological, intangible heritage and cultural values of the site.	Accept the management consequences of a dynamic site.
		Support geological research programmes and projects.
		Ensure that the unique character, distinctiveness and aesthetic quality of the Site's natural landscape is recognised, conserved and enhanced.
		Improve knowledge and understanding of the landscape character of the Site and its setting.
		Balance the management requirements of visitors with the Site's ecology.
		Interpret and promote the intangible values and cultural heritage of the site.
Socio-economic context	• Deliver tangible socio-economic benefits for local communities through the management and promotion of the site. • Maintain an appropriate setting and 'sense of place' for the site.	Support delivery of the Causeway Coast and Glens Tourism masterplan.
Visitor management and experience	Deliver and maintain a world-class and sustainable visitor experience at the site.	Seek to increase visits to the Site using public and/or other forms of sustainable transport.
		Signage and information on transport links should be easily available within the region and at the principal arrival points.
		Enhance the visitor experience without compromising the significance of the Site.
		Develop a Visitor Access Masterplan for the Site.
		Identify, monitor and address visitor safety issues at the Site.
		Maintain and improve the educational programmes and facilities on the Site.

Local Geodiversity Action Plans

Professor Cynthia Burek, University of Chester

Action Plans are a common mechanism within the business and biodiversity communities for effecting actions to achieve stated aims. They provide a focus on actions that matter, enable every issue to be addressed without duplication and allow progress to be monitored. Thus they provide a framework and methodology, which is transferable, accountable and transparent.

Historical development

Using the most applicable parts of the model developed by the Biodiversity Action Plan partnership in 1994, Local Geodiversity Action Plans (LGAPs) were developed. The first to be piloted were the Cheshire region and Warwickshire. The first of these was published in September 2003. Since then over 28 LGAPs are in existence whether published and implemented or being developed. They are normally county based, such as Cheshire region, West Lothian, or have some other administrative boundary such as an Area of Outstanding Natural Beauty (AONB), for example the North Pennines Area of Outstanding Natural Beauty 2004–9, or Gloucestershire Cotswolds.

What are LGAPs?

LGAPs are hierarchical methods for integrating Geodiversity into everyday actions and thus provide a new and effective route to achieving geoconservation.

LGAPs are becoming popular as a means of involving the wider local community in conserving and maintaining their geodiversity heritage sometimes within a cultural context.

A successful LGAP

The essential features of successful LGAPS are:

- A partnership of initially local and later national organisations and/or individuals who are interested and own the aim of the LGAP. This partnership should be inclusive not exclusive.
- A clearly defined, recognisable boundary acceptable to the LGAP partnership.
- A clear overarching aim which has been developed and therefore owned by the whole partnership.
- A series of objectives, which support the aim. The first of these is normally a geodiversity audit.
- Targets which underpin the aim supported by actions.
- Consultation is imperative at all stages.
- Measuring achievements and monitoring progress is needed.
- Making the process sustainable is imperative for success.

How an LGAP works?

LGAPs are processes not products. The aims, objectives, targets and actions must be clearly understood. An example of this is discussed in the case study Cheshire region LGAP.

At first glance many LGAPs may seem to be complex. However many actions serve more than one target and targets once achieved can often served more than one objective.

Typically LGAP objectives may include:

- Geodiversity audit of the defined local area. This is not just spatial but should include skills and other types of locally held information in libraries, museums and universities.
- Communication and education are important objectives to encourage all inhabitants to understand what is to be conserved.
- Influencing planning within strategic documents and to protect the geodiversity resource through local government plans and planning guidance, for example PPS9.
- Conservation and management goals which are clear and achievable for the management of geological sites, natural processes and landscapes.
- A statement on how the process is to become sustainable through established resources (money and people).

Conclusions

LGAPs are a new holistic approach to conserving geodiversity. They are processes not products and must be sustainable through planning guidance; embedded in job descriptions, etc. Ownership of the process is imperative.

The development of a National GAP may provide guidance for streamlining the approach to producing LGAPs.

The UK is the first country in the world to adopt this Local GAP approach and will provide best practice to other countries to safeguard their geodiversity.

Sustainable management of collecting pressure on palaeontological sites

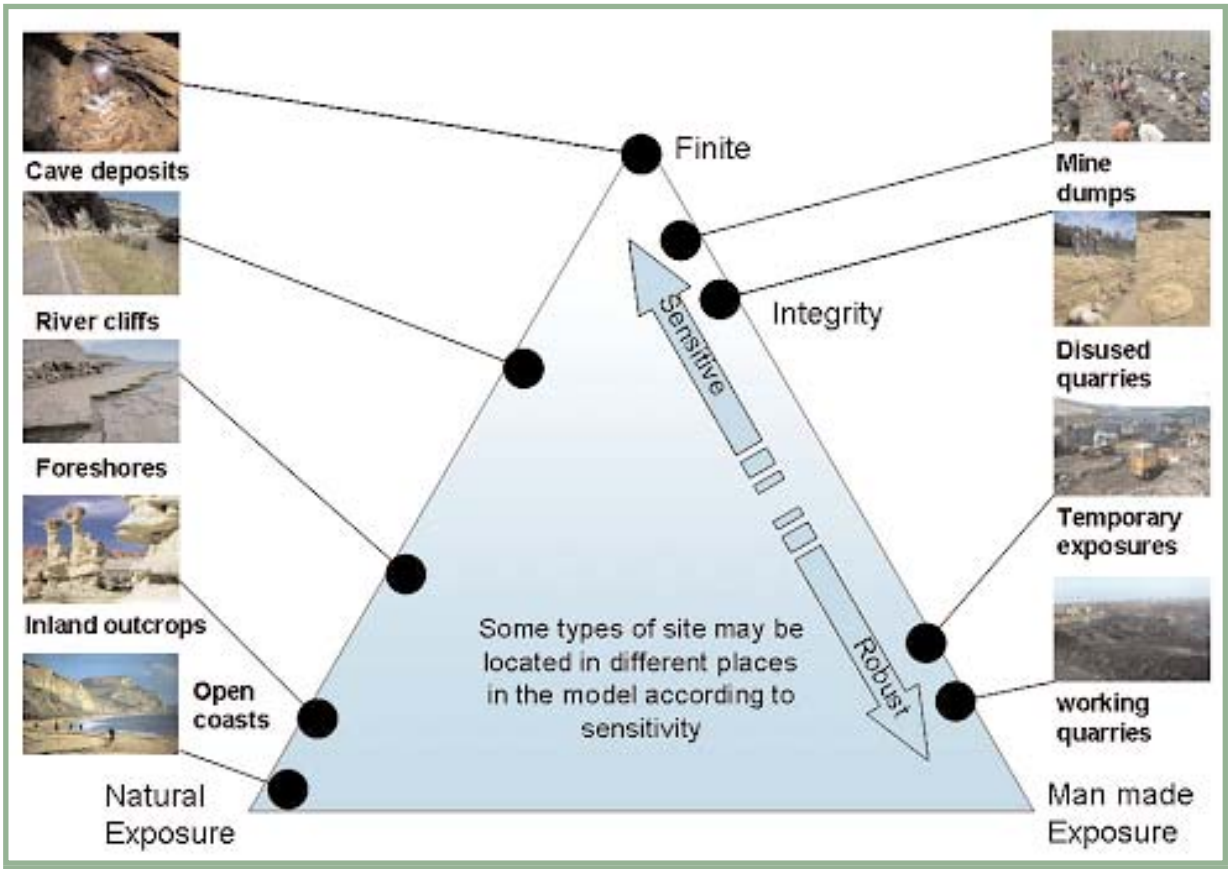
Richard Edmonds (Dorset and East Devon World Heritage Team), Jonathan Larwood (Natural England) and Tony Weighell (Joint Nature Conservation Committee)

Sustainable management of fossil collecting is based on the sensitivity of the site, the available palaeontological resource and its tolerance to collecting pressure. This paper aims to assist site managers to identify a broad management approach to the sites under their control and find consensus amongst the different parties with an interest in these sites on the basic principles of palaeontological site management.

Since 1990 (revised 2005) UK sites have been classified under the Earth Science Conservation Classification (ESCC). This identifies three categories according to their character: Exposure sites, such as an eroding coastline, are sites that have a geological resource that is extensive and frequently renewed. Integrity sites tend to be geomorphological in nature. Finite sites are those where the geological resource is irreplaceable such as a cave sediment or a derelict mine dump.

The management issues within this wide range of sites are varied. Exposure sites can sustain higher collecting pressures, especially where specimen rescue through collecting may be an important part of site management and conservation. Finite sites are more sensitive and require a different approach and more restrictive management.

Collecting pressures are created by user groups including casual collectors, the serious amateurs, the professional/commercial collectors, educational groups and researchers. Each can produce different pressures on a site but these pressures must be considered in the context of the sensitivity of the site in order to achieve sustainable management. Furthermore, the relationship between scientists and collectors is important in terms of promoting an understanding of the scientific interest and conservation value. Finally, there are the interests and responsibilities of landowners, complicated by the many and varied ownership laws between countries.



The Earth Science Classification System. Fossil sites can be classified according to their sensitivity and this is a reflection on the size of the site or resource and the erosional processes acting on it. The same type of site may lie in a broad range within the model, depending on its sensitivity. For instance, a river cliff in a small stream section will lie toward the finite end of the scale compared with the bank of a very large river or estuary where the erosion rates will be higher.

Some examples of ESCC sites:

Finite sites

Naracoorte Caves World Heritage Site, Australia: Cave deposits are typically the most sensitive sites. The amount of material is very limited, and once removed, can never be replaced. However, due to the small size of these sites and the restricted access, they can be controlled.

Writhlington: a disused mine tip: A disused coal mine tip rich in fossils. Although a finite site, the material is relatively inaccessible until machinery is deployed to turn it over. Access can be controlled and the process of exposure is predictable, allowing events for the pubic (pictured) under the supervision of scientists.

Horn Park: a disused quarry: Quarrying has ended and from a practical point of view, the remaining fossil bed is a limited resource. This, coupled with the internationally important nature of the fossils, means that this site should be regarded as entering the 'finite' category and treated accordingly. This is a sensitive site. Access can be controlled and should be as excessive or irresponsible fossil collecting will degrade and eventually destroy the interest.

Exposure sites

No specific example: a river cliff: River cliffs can vary hugely in sensitivity depending on the rate of erosion. Typically they are sensitive sites and should be managed accordingly.

Kimmeridge coast: a foreshore exposure: Like rivers, foreshores can vary in their size, scale and sensitivity. However, they are exposure sites and fossils may require recovery to avoid destruction from the sea.

Loders Bypass, Dorset: A temporary exposure created by a road cutting in 1988. The key to these sites is to identify the likely interest in the planning stage in order to ensure specimen rescue and recording. Where such sites have the potential to expose a large amount of material, collecting effort will be required. The process of exposure is predictable and the site can be controlled so conditions can be applied to access. Health and safety are important considerations.

Conesby Pit: A working quarry: Worked up until the late 1980s, this is a man-made exposure site with very low sensitivity. The site can be policed and the process of exposure is predictable. However, the window of opportunity is long term (years) and very many fossils would be crushed without daily collecting effort. Collectors can have a role to play in these sites but conditions can be allied because the site can be policed.

Inland exposures: Inland exposures vary hugely in their sensitivity from small, limited rock outcrops to vast desert or arctic tundra with sparse vegetation.

The West Dorset Coast: an open coast: Rapid erosion and a rich supply of fossils makes this a highly productive and robust site. The process of exposure is unpredictable, the window of opportunity is long term and access cannot be controlled. A high collecting effort is required in order to rescue the specimens from destruction but because the site cannot be policed, this can only be undertaken through a co-operative approach with collectors, recognising the time and effort that they invest.

A model has been developed for palaeontological site management, which challenges scientists and site managers to consider the level of collecting that is sustainable or necessary at different sites. Management must be both practical and achievable in order to be effective and this depends on a consideration of the requirements of science, conservation and the sensitivities of the site. A number of key management questions are identified and the answers point towards appropriate management. Indicators are also considered as a measure of management success. These indicators must address both the conservation of the site and the availability and destination of material of key scientific importance coming from it.

This model is illustrated using British examples and is also applied globally to palaeontological World Heritage Sites.

Geodiversity and tourism in Ireland: a sustainable balance

Patrick J. McKeever, Geological Survey of Northern Ireland

The 12 counties that comprise the north of Ireland cover an area of diverse scenery and landscape. From the rugged highlands and cliffs of Donegal to the drumlins of Cavan, Monahan, Armagh and down, the patchwork of scenery is based on the rich geological heritage of the region. Very few areas of comparable size across Europe, or indeed the world, are home to such a rich geodiversity spanning a time period of some 1700 million years.

Many of the most visited sites in this part of Ireland are either explicitly geological in nature (such as the Giant's Causeway in Antrim or the Marble Arch Caves European Geoparks in Fermanagh) or implicitly geological (such as the mountains of Donegal, Mourne and the Sperrins). Furthermore over recent years the joint work of the geological survey of northern Ireland and the geological survey of (the republic of) Ireland, primarily through their 'landscapes from stone' initiative, has done much to raise the public profile of the rich geological heritage of the region as well as highlighting many more sites and areas of geological interest. But many of these sites are sensitive to the pressure increased visitor numbers can bring and as a result the sustainability of such sites as visitor attractions is at the forefront of site development issues.

The Giant's Causeway (County Antrim) is famous for the, mostly, hexagonal columns of Palaeogene basalt which played a key role in unravelling the true nature of igneous rocks during the 18th century. Now designated as a World Heritage Site (only one of three in Ireland), the Causeway is host to over 500 000 visitors annually and is now on the 'must-see' list of many visitors coming to Ireland. At present there is basically no control over visitor access to the main area of Causeway columns and many visitors use a shuttle bus from the visitor centre to get down to the rocks. As a coastal site, exposed to the storms of the North Atlantic, there is little debate about the possible damage that may be done to rocks by the uncontrolled access to visitors compared to the natural erosion by wave damage. However the World Heritage designation does not just cover the main area of hexagonal basalt. It also extends further east along the cliffs to the spectacular Port na Spaniagh, an area where many of the key geological features of this World Heritage Site are displayed. The cliff path that once allowed access here has been closed off for many years and the path has been allowed to fall into disrepair. This has been done as this part of the Causeway is considered too dangerous, because of cliff erosion, to allow uncontrolled access to. While access is open, upon request, to geologists, it is strongly discouraged. These examples highlight the problems of sustainably managing a geological heritage site in a dynamic coastal environment where the safety of visitors and the need to allow access to one of the world's special sites of geological interest has to be balanced and constantly reviewed.

The Giant's Causeway, a World Heritage Site and one of Ireland's most visited tourist attractions but where the fragile coastal environment, the forces of nature and the pressure of visitor numbers must be balanced.

The Marble Arch Caves UNESCO European Geopark (County Fermanagh) is another area rich in geodiversity with the geopark comprising not only the underground world of the Marble Arch Caves but also the fragile limestone pavements and grasslands of the Marlbank and the vast stretches of upland bog on Cuilcagh Mountain.

Managing African geodiversity: The Gondwanaland geopark – a proposed geopark for Namibia

G. Schneider, Geological Survey of Namibia

Why a Namibian geopark?

Namibia is world famous for her wildlife parks, such as Etosha, so what's the need to add another dimension in the form of geoparks? The history of Earth is inscribed in its rocks so well exposed in Namibia. In these rocks we can trace the cycles of change and renewal that have shaped the Earth in the past. The geological history of the Earth and its rocks, minerals, fossils and landforms is not only an integral part of our natural world, but is intrinsically linked to the evolution of life. Geology has had a profound influence on Namibian society, civilisation and cultural diversity through mineral and energy resources, agriculture and water, forestry, mining, quarrying for building materials and tourism. Namibia's geological heritage is therefore of scientific, cultural and aesthetic significance. Namibia's geological heritage is on the other hand surprisingly fragile and vulnerable to destruction, by both natural and man-made processes.

There are a lot of potential benefits from geoparks for Namibia, such as:

- recognition of the relationship between people and geology;
- education and knowledge transfer;
- marketing of geotourism destinations and related socio-economic development;
- development of a national identity based on the natural environment;
- and public relations and promotion for geoscience institutions.

Namibia stands to gain directly in the form of increased tourism, employment opportunities for local communities, better returns for small-scale mineral specimen miners, increased awareness of the geo-environment amongst Namibians and a better protection for endangered sites.

On the other hand, the hurdles in the way comprise a lack of legislation and funding, no broad acceptance for the concept of geological heritage conservation, lack of staff in relevant organizations, and a lack of political support at communal and central government level. The way forward therefore includes lobbying of politicians, awareness campaigns, fund raising, liaison with established conservation OMAs and soliciting support from UNESCO.

The process

This process started with a UNESCO-sponsored workshop in Windhoek in early August 2004, which was officially opened by the Minister of Mines and Energy. During this workshop, a pilot area for a potential geopark, which comprises the complete geological history from the formation to the post break-up of Gondwanaland, was chosen, because of a high density of geological and cultural sites, as well as proclaimed national monuments. Furthermore, this area has abundant minerals and fossils, an interesting and specially adapted flora and fauna with obvious links to the geology, and a good existing infrastructure. A draft brochure for promotion and lobbying is currently being compiled, and contains details of the geology of the area, the history and current status of mining, the landscapes and the coast, cultural sites and infrastructure. Socio-economic aspects are also dealt with.

The United Nations Educational, Scientific and Cultural Organisation (UNESCO) has taken a decision in 2001 to support efforts of member states to promote territories or natural parks having special geological features through the inclusion in an international network of Geoparks.

The site

Namibia's spectacular landscapes and the geological history of its rocks, minerals, fossils and landforms are of unique geological importance and constitute a significant geological heritage. This proposal for Africa's first Geopark covers an area of approximately 60 000 km² and is situated between 20° and 22° south and 13° and 16° east, in the central western part of Namibia with the Atlantic Ocean as its western boundary. The area boasts scenic landforms, palaeontological and archaeological sites, rare minerals and rocks, and it bears witness to geomorphological processes. These are combined with ecological biodiversity of scientific and cultural significance as well as with cultural and historical aspects. The proposed Geopark is located in an area with an underdeveloped economy. Over the last 10 years, local communities have made tremendous efforts to develop and protect geological sites of scientific importance, forming part of Namibia's geological heritage. Local conservancies were established within the area with the aim to improve the living conditions of local communities and at the same time diversifying the rural economy. The popularization of earth sciences within the borders of a first Namibian Geopark could further strengthen the socio-economic development in a sustainable manner.

Conservation status for geological features

Most sites of geological interest in the proposed Geopark have no conservation status yet and are under considerable stress from unsustainable usage. They need to be protected within their rural environment. The local economy will be able to benefit from increased geotourism, if national and regional stakeholders can agree on management issues, and the responsibilities for the necessary conservation of geological heritage sites, including any physical maintenance. Participatory representation from all sections of the community needs to be secured, and should involve amongst others: public authorities, local organizations, private interests and research and educational bodies.

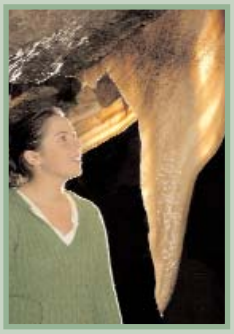
Awareness programmes for visitors to a Geopark will have to include education on environmental issues and sustainable development. Pedagogical programmes for schools need to be developed together with scientific explanations of geological features. Certain forms of geotourism have already become popular among Namibian and international tourists, and this has shown the need for sustainable heritage conservation, providing a foundation for education and scientific research and at the same time enabling the local communities to safe-guard and market their own resources and earn income from them.

Proclamation of Africa's first Geopark under UNESCO patronage will ensure the appropriate recognition, preservation and utilization of Namibia's important geological and geomorphological heritage.

These fragile geological environments also need to be sustainably managed and the geopark management authority, Fermanagh District Council, have established themselves as one of the pioneers in the field of the sustainable management of geological sensitive sites. Visitor numbers into the showcaves are strictly controlled and supervised at all times with great care being taken to ensure minimal interference with the fragile cave geology and the limited ecosystem that exists there. A new lighting system has recently been installed that not only enhances the aesthetics of the caves but also helps minimise damage to the cave ecosystem. On the surface, access to the blanket bog on Cuilcagh Mountain is not controlled in the strict sense but by placing a 'floating' wooden boardwalk over the surface of the bog, walkers are encouraged to follow a given route that again minimises damage to the bog. Furthermore, damage that had been done to the bogland prior to its incorporation into the geopark is now being rectified by a systematic programme of sustainable bog restoration by Fermanagh District Council.

Across Ireland, local communities are becoming increasingly aware that their geological heritage is of value and that it needs to be valued and promoted in a sustainable way. From the Copper Coast European Geopark in County Waterford to the Ring of Gullion of south County Armagh, communities are working to ensure that the rich geodiversity of Ireland will be sustained and promoted as an asset for everyone to enjoy.

Marble Arch Caves European Geopark



Marble Arch Caves and Cuilcagh Mountain Park were jointly the first European Geopark in the United Kingdom. The Geopark is operated by Fermanagh District Council and is located in the sedimentary carboniferous rocks of south-west Northern Ireland close to the Irish border. Cuilcagh Mountain dominates the area. Below the summit ridge are boulder fields while the middle slopes support one of Ireland's best preserved blanket bogs. Bog covers the northern sandstone and shale slopes before yielding to the most extensive area of karst or limestone scenery in Northern Ireland.

Blanket bog is a priority habitat within the European Commission's Habitats Directive. The UK has designated the Cuilcagh bog an Area of Special Scientific Interest (ASSI) and an Environmentally Sensitive Area. It is within the Fermanagh Caveland Area of Outstanding Natural Beauty. The ASSI is a Ramsar site, or Wetland of International Importance. The British and Irish governments have designated the blanket bog as a cross-border Special Area of Conservation (cSAC).

The limestone contains important sites such as Marble Arch Caves, one of the most notable Irish caves. The cave has well-developed main stream passages formed by three rivers that rise on the bog and sink in the massively bedded limestone. The sinks are impressive earth science features as one river disappears into the gaping Pollasumera cave, another flows through the glacial melt water channel of Monastir Gorge to sink below cliffs and the third has an intermittent dry bed. The rivers unite in Marble Arch Caves before the combined flow emerges as the Cladagh River, in the Cladagh Glen, at one of Ireland's largest resurgences beside the famous Marble Arch, a remnant cave passage. The Cladagh Glen is a National Nature Reserve and is one of the last Irish remnants of damp ash woodland.

In the show-caves, lively and informative guides conduct tours past a bewildering variety of cave formations. The cave tour runs every day throughout the open season, starting from the visitor centre. The visitor centre has fascinating displays on local history, geology and ecology and also offers a highly acclaimed audio-visual presentation. Education programmes are offered for Key Stage 1 (4 years) and upwards. Programmes comply with subject specifications in the curriculum and colour resource books are provided for the children taking part. Limestone, bogland and woodland field study programmes attract 5000 children each year.

The Geopark creates important economic benefits including 50 directly linked jobs and annually draws up to 50 000 visitors who generate significant tourism revenue within the regional economy. The European Geopark continuously adds to its education programmes, events, displays and walks to provide interest, education and a fun day out for all ages.

For more information visit: www.fermanagh.gov.uk.