

and has recommended steps to remove tourist facilities from fragile areas. Much of the cave system is not accessible to the public, and 1980 tourism was 25% less than in 1973; a tourism development plan provides for staging areas outside the cave drainage.

7. COMPARISON WITH OTHER AREAS

Mammoth Cave system is well over twice as long as the next-largest cave system (Hölloch in Switzerland, 135 km). According to Dr. Arrigo A. Cigna, President of the Union Internationale de Spéléologie, "No other cave system in the world can be compared with it".

8. EVALUATION

The limestone caverns of Mammoth Cave contain a natural spectacle of world interest. The site illustrates a number of stages of the Earth's evolutionary history, contains on-going geological processes, has superlative examples of natural features, and contains unique wildlife. It is protected by the US National Park Service, which has been charged by Congress to manage, develop, interpret and preserve the site. The possible dangers to the integrity of the site have been considered and steps are being taken to limit their influence.

9. RECOMMENDATION

The Mammoth Cave National Park meets the criteria of the Convention and should be placed on the World Heritage List.



International Union for Conservation of
Nature and Natural Resources

July 1981 (rev)

NAME Mammoth Cave National Park

MANAGEMENT CATEGORY II (National Park)
World Heritage Site (Criteria: i, ii, iii, iv)

BIOGEOGRAPHICAL PROVINCE 1.9.7 (Chihuahuan)

LEGAL PROTECTION No information

DATE ESTABLISHED 1 July 1941. Accepted as a World Heritage Site in 1981.

GEOGRAPHICAL LOCATION Situated in Barren, Edmonson and Hart Counties, Kentucky. 37°07'30"-17'30"N, 86°00'00"-17'30"W.

ALTITUDE No information

AREA 21,191ha

LAND TENURE Public ownership except 6 parcels of private land totalling 3.7ha.

PHYSICAL FEATURES The Park contains the longest cave system in the world, with known passages extending some 306km and perhaps an equal length of undiscovered passages. It was formed over 100 million years ago by the Green River and its tributaries and the geological process is continuing. Most types of cave formation are found here and features include the long passages with huge chambers, vertical shafts, stalagmites and stalactites and gypsum "flowers" and "needles". Outside the cave there is superb karst topography with all the features of a karst drainage system - a vast recharge area, complex network of underground conduits, sinkholes, cracks, fissures, and surface and underground springs. Fossils are distributed throughout the rocks of the Mississippian age and include brachiopods, crinoids and corals. Mean annual precipitation is 1,270mm.

VEGETATION Luxuriant vegetation outside the cave system and a rich cave flora. Communities on the surface of the plateau include 84 tree varieties, 28 varieties of shrubs and vines, 29 types of ferns, 209 wildflowers, 67 species of algae, 27 species of fungi and 7 species of bryophytes. The Big Woods basin ecosystem (120ha) is reputed to be one of the best remaining examples of a virgin white oak/black oak Quercus velutina/tulip tree Liriodendron tulipifera forest in eastern North America and the cedar Cedrus sp. karren and savannas of the solution valleys are also of scientific interest.

NOTEWORTHY FAUNA The richest cavernicolous wildlife known, including species endemic to the cave system occur in the Park. There are 41 species of mammals, 203 species of birds, 18 varieties of reptiles, 15 species of amphibians and numerous invertebrates. Bat colonies include the Indiana bat Myotis sodalis (V). Of special concern is the Kentucky cave shrimp Palaemonias ganteri, a freshwater species of uncertain status. The geological setting has contributed to the species richness of the area with the cave system being old enough to have stable communities of fauna from three karst regions within an area large enough for speciation to have occurred. Nowhere else do the blind fish Amblyopsis spelaea and Typhlichthus subterraneus and their spring-cave dwelling relative Chologaster agassizi co-exist. Animal

species considered threatened and found only in the Mammoth Cave area include Kleptochthonius hageni, K. cerberus, Anthrobia monmouthia, Antriadesmus fragilis, Pseudoanophthalmus audax, P. inexpectatus, Vatrisoides henroti, Dorypteryx hageni, Arrhopalithes altus, Helicodiscus punctatellus, Sagittocythere stygia and Paleomonias ganteri.

CULTURAL HERITAGE

The Park contains evidence of 4 pre-Columbian Indian cultures: Mississippian, Woodland, Archaic and Paleo-Indian. The early Woodland culture period is of special archaeological importance because it shows the first evidence of organized horticulture in North America with primitive agriculture on river floodplains and was the period of the first exploration and mining in Mammoth Cave. Several mummies, sandals, campfire sites, bare foot prints have been found preserved in the stabilizing cave atmosphere.

ZONING

No information

CONSERVATION MANAGEMENT

The Master Plan for the National Park (1977) has recommended steps to remove tourist facilities from fragile areas.

DISTURBANCES OR DEFICIENCIES

Damage to some irreplaceable cave resources occurred during the early periods of cave use, and it is proposed that further damage be avoided by the relocation of essential visitor services from the Historic entrance to a peripheral area. The area adjacent to the Park is now turning from agriculture to light industry. Of major environmental concern is the Sinkhole Plain to the south and east of the Park. Precipitation falling on this extensive area collects in underground streams and is finally discharged into the Green River. Any changes in quality or quantity of water would adversely affect the unique aquatic life of the underground streams and alter natural cave development. Tourism is disturbing the cave system and particularly the bats, however, only limited access to the cave system is available to the public on organized cave tours. Tourism was 25% less in 1980 than in 1973 (1.9 million). The scattered distribution of the few small private tracts makes development in the Park unlikely.

SCIENTIFIC RESEARCH

A professional geologist is studying the hydrogeological and environmental relationships at Mammoth Cave. In 1981 the Environmental Agency was studying the environmental impact of the proposed wastewater system.

SPECIAL SCIENTIFIC FACILITIES

No information

PRINCIPAL REFERENCE MATERIAL

No information

STAFF

Superintendent for on-site administration assisted by managers and specialists skilled in administration, resource management, maintenance and visitor protection.

BUDGET

No information

LOCAL PARK OR RESERVE ADMINISTRATION

U.S. Department of the Interior, 18th and C Street, N.W., Washington D.C. 20240, U.S.A.

DATE

July 1981.

UNITED STATES OF AMERICA - Kentucky

NAME Mammoth Cave Area Biosphere Reserve

IUCN MANAGEMENT CATEGORY II (National Park)
X (World Heritage Site: Criteria i,
ii, iii, iv)
IX (Biosphere Reserve)

BIOGEOGRAPHICAL PROVINCE 1.05.05 (Eastern Forest)

GEOGRAPHICAL LOCATION Situated in Barren, Edmonson and Hart counties, South Central Kentucky near Park City, which lies within the transition area. 37°07'-37°17'N, 86°00'-86°17'W

DATE AND HISTORY OF ESTABLISHMENT The area was declared a national park on 1 July 1941, under enabling legislation of US Congress (44 Statute 635) of 25 May 1926. Kentucky ceded exclusive jurisdiction over park lands by an act of legislature approved on 22 March 1930 and this was accepted by the Secretary of the Interior on 1 May 1944 by authority of the act of 5 June 1942 (56 Statute 317). Exclusive jurisdiction over the remainder of the land was accepted on 1 May 1965. Certain roads through the park are legally open to the public under Deed No.262 of 18 June 1945. Part of the area is endorsed by the Barren River Area Development District resolution of 24 October 1988. Big Woods Old-growth Forest is designated a state natural area by the state of Kentucky. Green River is designated a wild and scenic river and Green River and Mammoth Cave subsurface streams are designated outstanding resource waters by this state. Accepted as a World Heritage site in 1981 and as a biosphere reserve in 1990.

AREA National park 21,191ha; the area included in the biosphere reserve is 21,217ha, comprising a core area of 20,917ha and buffer zones of 300ha; an additional transition zone covers 62,160ha.

LAND TENURE The national park (core area) is federally owned

ALTITUDE 180-231m

PHYSICAL FEATURES The park is situated in an area known as the Mammoth Cave Plateau and contains an internationally important karst area. The core area is a dissected plateau known as the Chester Upland, formed of sandstone-capped ridges separated by karstified valleys containing sinkholes. It also contains the longest cave system in the world, with known passages extending for over 532km. Most types of limestone cave formation are found here, including long passages with huge chambers, vertical shafts, stalagmites, stalactites and gypsum 'flowers' and

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'needles'. On the surface there is a superb karst topography with largely subsurface drainage, sinkholes, cracks, fissures and springs. Groundwater flows from the extensive recharge areas on the plateaux to the southwest through the park's cave system to springs that discharge into the Green River. The erosion by the Green River and its tributaries which formed this system began over 25 million years ago and these rivers are now meandering and deeply incised. The limestone rocks of Upper Mississippian age are highly soluble and include contain fossils throughout, including brachiopods, crinoids and corals. The main series in which the cave systems and karst landscape have developed are the St Louis, St Genevieve and Paoli limestones of the Meramecian. The Chester Upland is capped by sandstones of the Upper Mississippian-Lower Pennsylvania periods. Structural dip in the north-west is about 5m/km. The major soil types are those developed from limestone residuum and are either alfisols or ultisols. To the east, south and west of the park (included in the transition zone) is the Pennyroyal Plateau which is separated from the Chester Upland by an escarpment.

CLIMATE Conditions are humid temperate. Mean annual precipitation is 1118mm at an altitude of 205m and practically all of it is in the form of rain as temperatures are generally above freezing during the day. Mean annual temperature is 13.6°C with a summer mean of 26.6°C and a winter mean of 1.7°C.

VEGETATION There is a luxuriant surface vegetation, including 84 tree species, 28 shrubs and vines, 29 species of fern, 209 flower species, 67 species of algae, 27 species of fungi and seven species of mosses. An inventory of the flora is included in the biosphere reserve nomination. Big Woods is reputed to be one of the largest and best remaining examples of the ancient forest of eastern North America that once covered Kentucky. This is temperate deciduous oak-hickory forest dominated by oaks including Quercus alba, Q. velutina, Q. prinus and hickories including Carya glabra and C. tomentosa with some beech Fagus sp., maples Acer spp. polpar Liriodendron sp., ash Fraxinus sp. and cedar Juniperus virginiana.

FAUNA Over 200 species are indigenous to the cave system. On the surface are 41 species of mammals, 203 species of birds, 18 species of reptiles and 15 species of amphibians. A faunal list is included in the biosphere reserve nomination. The age of the geological formations has contributed to species richness in the cave fauna, the cave system being old enough to have communities from three karst regions and covering an area large enough for speciation to have occurred. Nowhere else do blind fish Amblyopsis spelaea (V), Typhlichthus subterraneus and their spring cave-dwelling relative Chologaster agassizi co-exist. Resident animal species listed as federally endangered include freshwater mussels Obovaria retusa (I), Hemistena lata (E), Pleurobema plenum (E) and Lampsilis orbiculata (E), Indiana bat

Myotis sodalis (V), grey bat M. grisescens and Kentucky cave shrimp Plaesmonias ganteri. There have been successful reintroduction of wild turkey, beaver and deer.

CULTURAL HERITAGE The park contains evidence of four pre-Columbian Indian cultures: Mississippian, Woodland, Archaic and Paleo-Indian. The early Woodland culture period is of special archaeological importance because it shows the first evidence of organised horticulture in North America, with primitive agriculture on river floodplains. These Indians used the caves for shelters and chipped gypsum and mirabilite off the walls; more than 150 archaeological sites have been identified within the national park. Saltpetre deposits were discovered on the cave walls and this valuable nitrate was removed and sent to be processed in gunpowder factories between 1809 and 1819. After the 1812-1815 war Mammoth Cave became a national and international tourist attraction. Three churches and fourteen cemeteries still exist in the park and are used by the public.

LOCAL HUMAN POPULATION There are no permanent inhabitants in the core area. About 240 people live in the buffer zones with a further 1500 in the transition area, including about 600 in Park City. Population density in the region surrounding the park is low (30 per sq.km) and has remained stable for the past 20 years. Only 25% of the population is considered urban and no significant increase in urbanisation is expected in the near future. Most people are engaged in agriculture, tourism or service industries.

VISITORS AND VISITOR FACILITIES Since a peak in 1979 of 1.6 million visitors, numbers remained stable near this level into the 1980s with an increase occurring in recent years to about 2 million per annum. The summer months of June, July and August account for over 60% of the annual total. Park headquarters are located at the historic entrance to Mammoth Cave and there is a visitors' centre here, but this is very small. Guided tours are offered of the underground portion of the park and there are commercial boat trips on Green River. There are 155km of roads within the park and many hiking trails including over 45 miles in the remote section of the park but there are only two small ferries across the Green River so that resources in much of the remoter hilly areas of the park remain untapped. Access is good and it is estimated that a third of all visitors do no more than drive through the park. There are about 110 rooms in a hotel, lodge and various cottages and restaurant and shopping facilities in the buffer zone but a further 2,000 motel rooms and over 7,500 campsite places are located within easy distance of the park.

SCIENTIFIC RESEARCH AND FACILITIES Long-term hydrological and ecological research into karst systems is being carried out in the Mammoth Cave area, including the effects of water quality on the cave's biota. In particular, research into groundwater flow-pulse rates and modelling has been applied to the

development of instrumentation packages for monitoring the physical and chemical properties of groundwater. Preliminary discussions of the international applications of this have been initiated. Much research into a variety of aspects has already been carried out. A research facility and laboratory are available to visiting researchers. The US Geological Survey plans to further delineate groundwater basins in the area and the Agricultural Stabilisation and Conservation Service will be studying the effects of agriculture on groundwater in the transition zone. There are cooperative agreements with Western Kentucky University, Eastern Kentucky University, the Cave Research Foundation and the American Cave Conservation Association for research and education or training opportunities.

CONSERVATION VALUE The Mammoth Cave area is an internationally important karst area. It contains the longest cave system in the world, with known passages extending for over 532km. Most types of limestone cave formation occur here. Over 200 species of animal are indigenous to the cave system including several endangered species of blind fish, shrimp, bat and freshwater mussel. Surface features are also important and Big Woods, a temperate deciduous oak-hickory dominated forest, is reputed to be one of the largest and best remaining examples of the ancient forest of eastern North America that once covered Kentucky. Archaeological sites in the area show evidence of four pre-Columbian Indian cultures.

CONSERVATION MANAGEMENT The core area (Mammoth Cave National Park) is managed by the National Park Service. The transition zone falls within Barren River Development District of which three counties are within the Mammoth Cave system recharge area. The Biosphere Reserve Cooperative Subcommittee of the Natural Resources Council of the Barren River Area Development District will coordinate biosphere reserve functions. The general management plan for the national park (1983) states that the management aims at Mammoth Cave National Park are to perpetuate the integrity and diversity of geological features and life systems associated with the caves and preserve aquatic and terrestrial environments for their aesthetic, recreational, educational and scientific values. Within the core the management plan identifies separate natural zones and historic zones and it classifies caves into six types according to the access approved. A resource management plan has been compiled (Anon., 1988), which includes natural and cultural resource management programmes. The oak-hickory woods of the national park are being allowed to return to their natural state. Some of the oak and poplar forests are currently managed but there are no plantations. As well as public recreation, authorised fishing and hunting is permitted in the core area. Narrow corridors along roads within the core zone have been designated as zones of managed use and concentrate tourist developments, administrative and recreational facilities. A transition zone for the biosphere

reserve has also been designated to the south and east of the core area to curtail groundwater pollution as this is where much of the rainwater which flows through the cave systems of the park falls. Federal, state and local authorities have cooperated to develop a regional sewer system in this area, surrounding Park City, to stop pollutants reaching the groundwater.

MANAGEMENT CONSTRAINTS Damage to irreplaceable cave features occurred during the early periods of cave use, including smoke deposits from torches and fires and graffiti. The use of electric lighting for cave tours has also led to the introduction and growth of mosses, fungi and algae in the caves and may eventually spoil the natural beauty of some of the unique formations. At least 130 cave entrances have been identified as needing some level of monitoring for illegal entry. Several cave gates are in need of repair. Oil and gas wells were also drilled in this area and although those inside the park were abandoned when it was established they still pose a threat to human safety and environmental quality as many have been insufficiently plugged. In adjacent areas, oil and gas exploration has increased recently and with this, the risks of spillages into the park's groundwater system including that of injected dyes. About half of the Mammoth Cave system actually lies outside the national park boundaries but management of these areas should be improved by the designation of a transitional zone to the biosphere reserve. Commercial freshwater mussel fishing outside the park has destroyed the natural mussel beds there and illegal operations have expanded into the park, resulting in conviction of the operators.

A wide variety of arable and animal farming occurs in the transition zone and this area is now increasing its light industry. However, solution of the existing pollution problems should provide a basis for increased opportunities to attract sustainable economic development compatible with the karst terrain. Of major environmental concern is the extensive sinkhole plain to the south and east of the Park. Run-off from this area flows via underground streams into the Green River and includes effluent from Park City. There has also been illegal dumping of wastes into sink holes in the transition zone. Any changes in quality or quantity of water would adversely affect the unique aquatic life in the underground streams and alter natural cave development but this problem is now being addressed (see previous section).

STAFF The biosphere reserve has a staff of 94. Of these, 20 are involved in administration, control and resource management within the core area and 17 are university educated. There are 12 staff for education and training purposes and three involved in research who have a technical support of up to ten personnel.

BUDGET US\$ 3,500,000 annually

WCMC/UNESCO Draft World Heritage Database, March 1994

LOCAL ADDRESSES Mammoth Cave National Park, Mammoth Cave,
Kentucky 42259

REFERENCES

Anon. (1983). General management plan, Mammoth Cave National
Park, Kentucky. Denver Service Center.

Anon. (1988). Resource Management Plan for Mammoth Cave National
Park. Draft.

MAB USA (1990). Mammoth Cave Area biosphere reserve. Biosphere
Reserve nomination form.

DATE July 1981, revised October 1989 and September 1990

DOCUMENT 0359U

PATRIMOINE MONDIAL: CANDIDATURE

EXAMEN TECHNIQUE PAR L'UICN

1. NUMERO D'IDENTIFICATION ET NOM: 150 Parc national des grottes du Mammoth
2. SITUATION GEOGRAPHIQUE: Comtés de Barren, Edmonson, et Hart, Etat du Kentucky, Etats-Unis d'Amérique, 86° 10'0, 37°10'N
3. CANDIDATURE PROPOSEE PAR: Le Service des parcs nationaux, Département de l'Intérieur, gouvernement des Etats-Unis
4. DOCUMENTATION:
 - (i) Formulaire de candidature (avec carte et photos)
 - (ii) Documentation complémentaire (UICN)
 - a) Consultation de M. M.E. Tuttle, Smithsonian Tropical Research Institute (spécialiste des chiroptères)
 - b) Consultation de M. Arrigo A. Cigna, président de l'Union internationale de spéléologie.
5. PRESENTATION RESUMEE

Le parc national des grottes du Mammoth comporte de loin le plus long réseau de grottes du monde, avec ses passages connus qui s'étendent jusqu'à quelque 306 km, et une longueur peut-être égale de galeries encore à découvrir. Ce réseau revêt une importance géologique du fait de la formation de grottes qui s'y déroule depuis 100 millions d'années sous l'action de la rivière Verte et de ses affluents. Ce site présente pratiquement tous les types de formation de grottes et les processus géologiques impliquant la formation de grottes s'y poursuivent encore. Les longs passages aboutissant à de vastes cavités, les puits verticaux, les stalagmites et les stalactites, les "fleurs" et les "aiguilles" de gypse et les autres caractéristiques naturelles de ces grottes sont tous des exemples du genre particulièrement saisissants. Leur flore et leur faune sont parmi les plus riches qui soient, avec leurs 300 espèces cavernicoles, dont 12 sont rares et endémiques. En dehors de la grotte, la topographie offre un relief karstique magnifique; les paysages sont remarquables, la végétation est luxuriante et la faune abondante. Toutes les caractéristiques d'un système de drainage karstique sont présentes dans ce site - vaste zone d'alimentation, réseau complexe de conduits souterrains, trous, crevasses, fissures, sources de surface et souterraines. Les grottes du Mammoth ont joué un rôle important dans le développement de la culture humaine, quatre périodes culturelles distinctes étant décrites: le paléo-indien, l'archaïque, la culture de la forêt claire et mississippien. Le début de l'ère de la forêt claire est particulièrement importante en ce qu'elle marque le développement indépendant de la culture des jardins dans l'hémisphère occidentale.

6. INTEGRITE

Le site inclut tout le réseau de grottes; il répond donc aux critères 21 (ii) et (iii). Toutefois, il n'englobe pas tout le bassin de drainage des eaux du site, de sorte qu'on ne peut éliminer la possibilité d'une perturbation que l'autorité responsable ne serait pas à même de contrôler, surtout au sud et à l'est du parc, là où l'industrie légère remplace l'agriculture. L'Agence de

protection de l'environnement prépare une étude sur une installation de traitement des eaux usées pour le site et les communautés locales, et sur de petites usines de traitement des eaux usées, car les communautés voisines ont été financées en partie par le service des parcs nationaux. Le tourisme est aussi une menace; certaines colonies de chauves-souris ont ainsi été perturbées. Ce risque est reconnu dans le plan directeur établi pour le parc et le retrait des installations facilitant le tourisme a été recommandé pour les régions fragiles. Une bonne partie du réseau de grottes n'est pas accessible au public; en 1980, le tourisme a été 25% inférieur à 1973. Un plan de développement du tourisme prévoit des zones étapes en dehors du système de drainage des grottes.

7. COMPARAISON AVEC D'AUTRES REGIONS

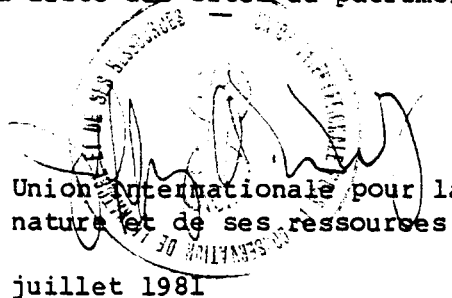
Le réseau des grottes du Mammoth est plus de deux fois plus long que le 2^e réseau, celui d'Hölloch, en Suisse (135 km). Selon M. Arrigo Cigna, président de l'Union internationale de spéléologie: "nul autre ensemble de grottes ne peut rivaliser avec celui-ci".

8. EVALUATION

Les grottes de grès du Mammoth offrent un spectacle naturel d'intérêt mondial. Ce site illustre plusieurs étapes de l'histoire de la Terre; des processus géologiques s'y poursuivent. Il offre des exemples remarquables de traits naturels et abrite une faune unique. Il est protégé par le US National Park Service qui a été chargé par le Congrès de gérer, développer, présenter au public et préserver le site. Les risques que pourrait courir son intégrité ont été considérés et des mesures sont prises pour les limiter.

9. RECOMMANDATION

Le parc national des grottes du Mammoth répond aux critères de la convention et devrait être inscrit sur la liste des sites du patrimoine mondial.



Union internationale pour la conservation de la
nature et de ses ressources

juillet 1981