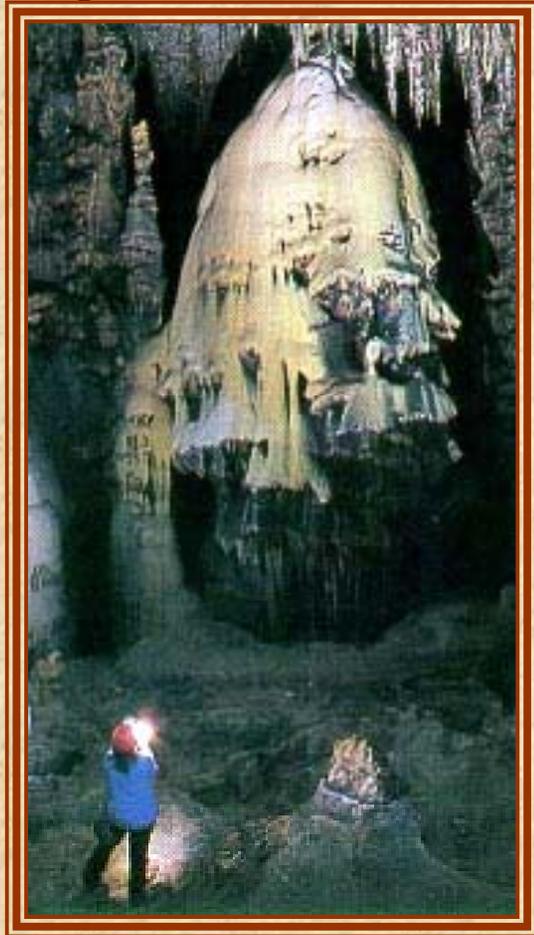




National Park Service

Cave and Karst Programs

<http://www2.nature.nps.gov/grd/geology/caves/index.htm>



- **STEWARDSHIP**
- **RESPONSIBILITY**
- **SCIENCE**
- **COOPERATION**
- **COORDINATION**
- **EDUCATION**

INSIDE EARTH

<http://www2.nature.nps.gov/grd/geology/caves/index.htm>

National Park Service

Cave and Karst Resources

- [Cave and Karst Program](#)
- [Inside Earth Newsletters](#)
- [Tour of Cave and Karst Parks](#)
- [The National Cave and Karst Research Institute Act](#)
- [Federal Cave Resources Protection Act](#)
- [Dept. of Interior Cave Management Regulations](#)
- [Selected Cave Links](#)



INSIDE EARTH
A Newsletter of the National Park Service Cave & Karst Programs



Vol. 5, No. 1 Late Spring 2002

Edited by Dale L. Pate

Table of Contents	
National Cave and Karst Research Institute Progress in 2002	1
Park Updates	
Carlsbad Cavern	1
Wind Cave	2
Formation Repair at Jewel Cave	4

Website Address:
<http://www2.nature.nps.gov/grd/geology/caves/newsletter.htm>
Webmaster: Jim F. Wood: jim_f_wood@nps.gov

NATIONAL CAVE AND KARST RESEARCH INSTITUTE PROGRESS IN 2002
by Zelda Chapman Bailey

Key activities during the two-year interim period (2000-2002) of establishing the National Cave and Karst Research Institute (the Institute) were defining the scope of operation, designing an organizational structure, forming partnerships, finding funding sources and a physical facility, and defining research needs. Considerable progress has been made in all these areas toward making the Institute operational.

The Institute will require about 12 employees to fully accomplish the goals, including the lead positions of Director, Science Coordinator, Education Coordinator, and Information Coordinator, and support staff under their direction. Voluntary advisory boards made up of representatives from a range of disciplines and organizations will play an important role in guiding the science and educational undertakings of the Institute. A nationwide announcement will be issued in summer 2002 to recruit the permanent Director for the Institute. The Director should report to Carlsbad early in fiscal year 2003. If additional operating funds are appropriated for 2003, additional positions will be recruited, probably including the Science Coordinator and administrative staff.

The Institute will not conduct research internally but will guide, focus, and encourage research through grants and partnerships. A primary function of the Institute will be to accumulate and organize data and information to make it accessible to investigators and for the Institute staff to use for synthesis of information on regional and national scales. The Institute will encourage focused research and studies in caves and karst systems so that a more

Inside Earth- Vol.5, No.1 - Late Spring 2002 1

National Park Service Cave and Karst Resources



*“Lower Cave”, Carlsbad Cavern,
Carlsbad Caverns National Park,
New Mexico*

- Caves and karst features occur in 120 (81 contain caves and an additional 39 contain karst) parks in all regions of the National Park System. Over 3,900 caves are currently known throughout the system. Eleven parks provide regular guided tours of 17 caves. The number of caves per park unit ranges from 10 caves—as in the Chesapeake & Ohio Canal National Historic Park, to more than 400 caves—as in the Grand Canyon National Park.
- Ek, David, report to the 2001 Geologic Resources Division Annual Report

NPS national cave/karst program

- **The NPS national cave/karst program is managed by one person in a central office. Servicewide, as of 2002, 21 people stationed in 14 park units are devoted to cave and karst management, even though 81 parks have significant cave or karst resources.**



Cave and Karst Areas of the NPS



Karst - What does it mean?



- **region of irregular topography with sinks, underground streams, caves and springs**
- **formed by water percolating through water soluble rock**

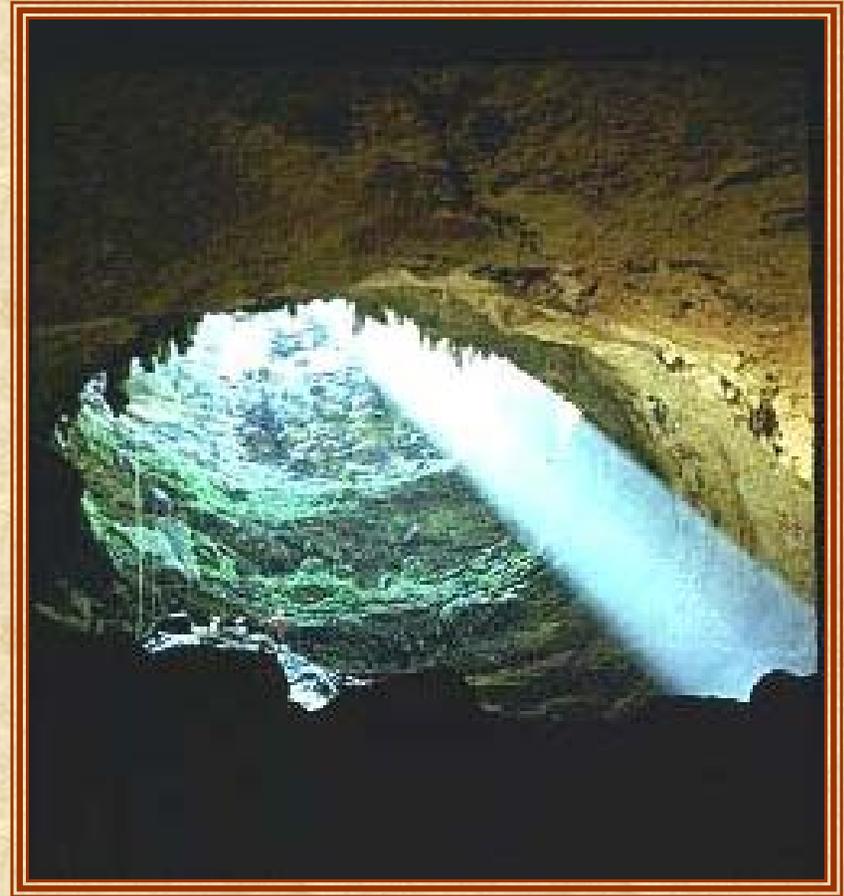
Why are caves important?



- **Source of water supply**
 - ground water
- **Contain important information including:**
 - microbes
 - archeological material
 - paleoclimatic evidence
 - human history and evolution

How are caves threatened?

- **mining: oil & gas**
- **landfills**
- **toxic waste repositories**
- **infra-structure**
- **spills**
- **overgrazing**
- **fires**



The Federal Cave Resources Protection Act of 1988

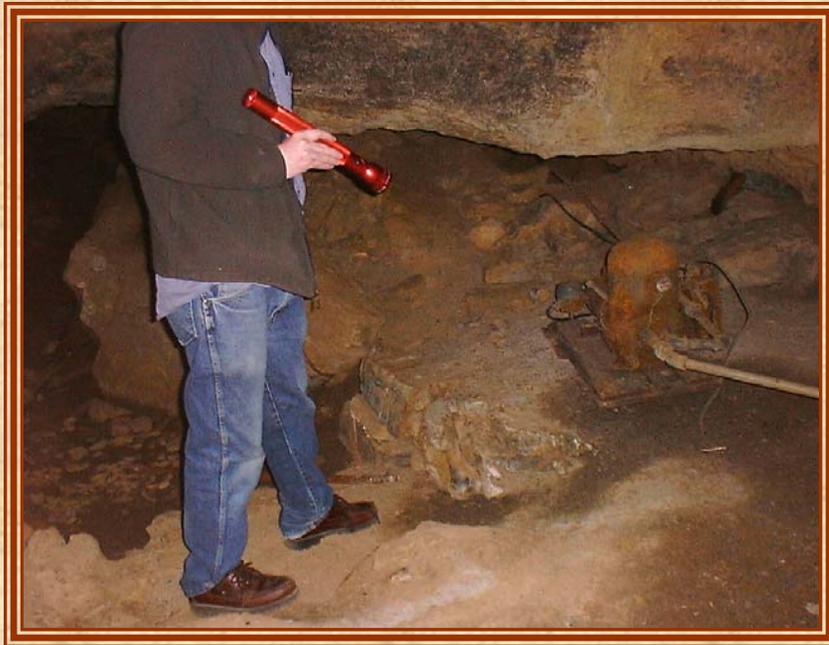
- In 1988, the U. S. Congress created a major impetus for the involvement of the United States in cave and karst protection and management by passing the landmark **Federal Cave Resources Protection Act of 1988** (Public Law 100-691; November 18, 1988). The act directs the secretaries of the Department of the Interior and the Department of Agriculture to inventory and list significant caves on federal lands and to provide management and dissemination of information about caves. A current, nationwide assessment of significant federally owned caves is cataloging the known caves on federal land and further increasing the impetus for cave management and research.

Significant Cave Criteria-Biota



- **Biota.** The cave provides seasonal or yearlong habitat for organisms or animals, or contains species or subspecies of flora or fauna that are native to caves, or are sensitive to disturbance, or are found on State or Federal sensitive, threatened, or endangered species lists.

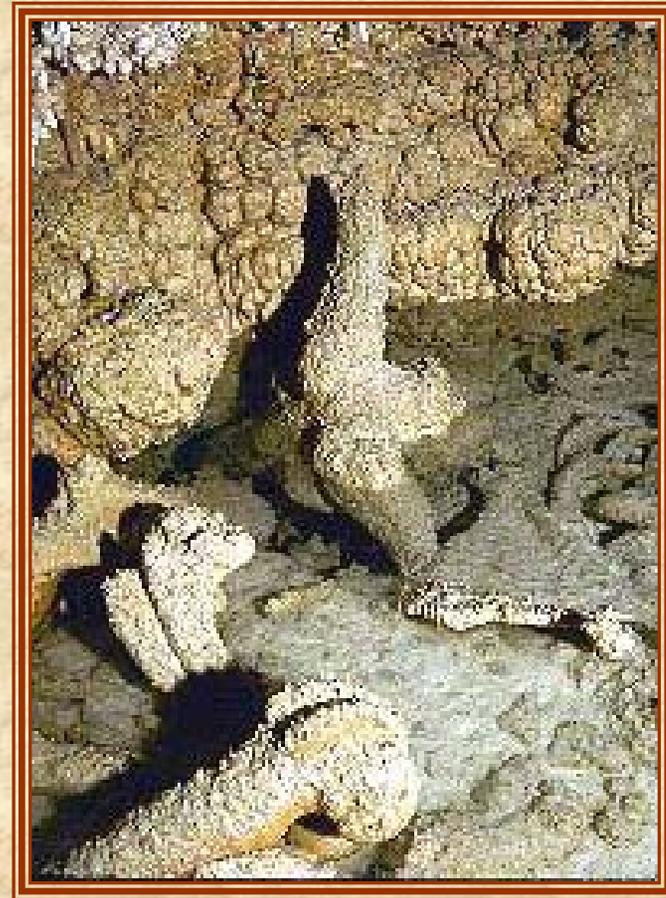
Significant Cave Criteria- Cultural



- **Cultural.** The cave contains historic properties or archaeological resources (as described in 36 CFR 60.4 and 43 CFR 7.3) or other features that are included in or eligible for inclusion in the National Register of Historic Places because of their research importance for history or prehistory, historical associations, or other historical or traditional significance.

Significant Cave Criteria- Geologic/Mineralogic/Paleontologic.

- **Geologic/Mineralogic/Paleontologic.** The cave possesses one or more of the following features:
- **(i) Geologic or mineralogic features that are fragile, or that exhibit interesting formation processes, or that are otherwise useful for study.**
- **(ii) Deposits of sediments or features useful for evaluating past events.**
- **(iii) Paleontologic resources with potential to contribute useful educational and scientific information.**



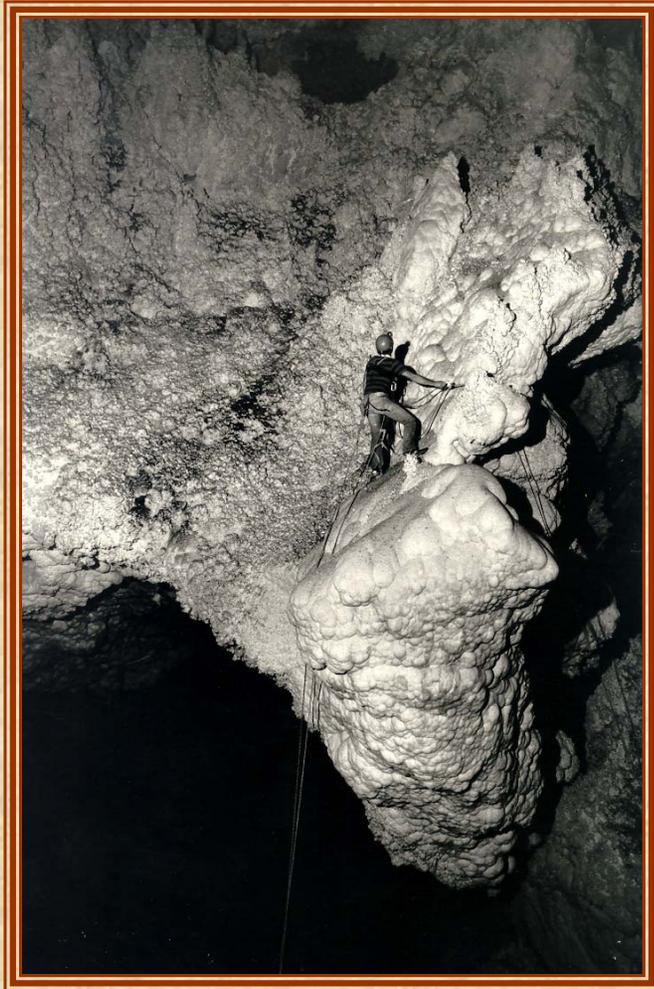
Significant Cave Criteria-

Hydrologic

- **Hydrologic.** The cave is a part of a hydrologic system or contains water that is important to humans, biota, or development of cave resources.



Significant Cave Criteria- Recreational



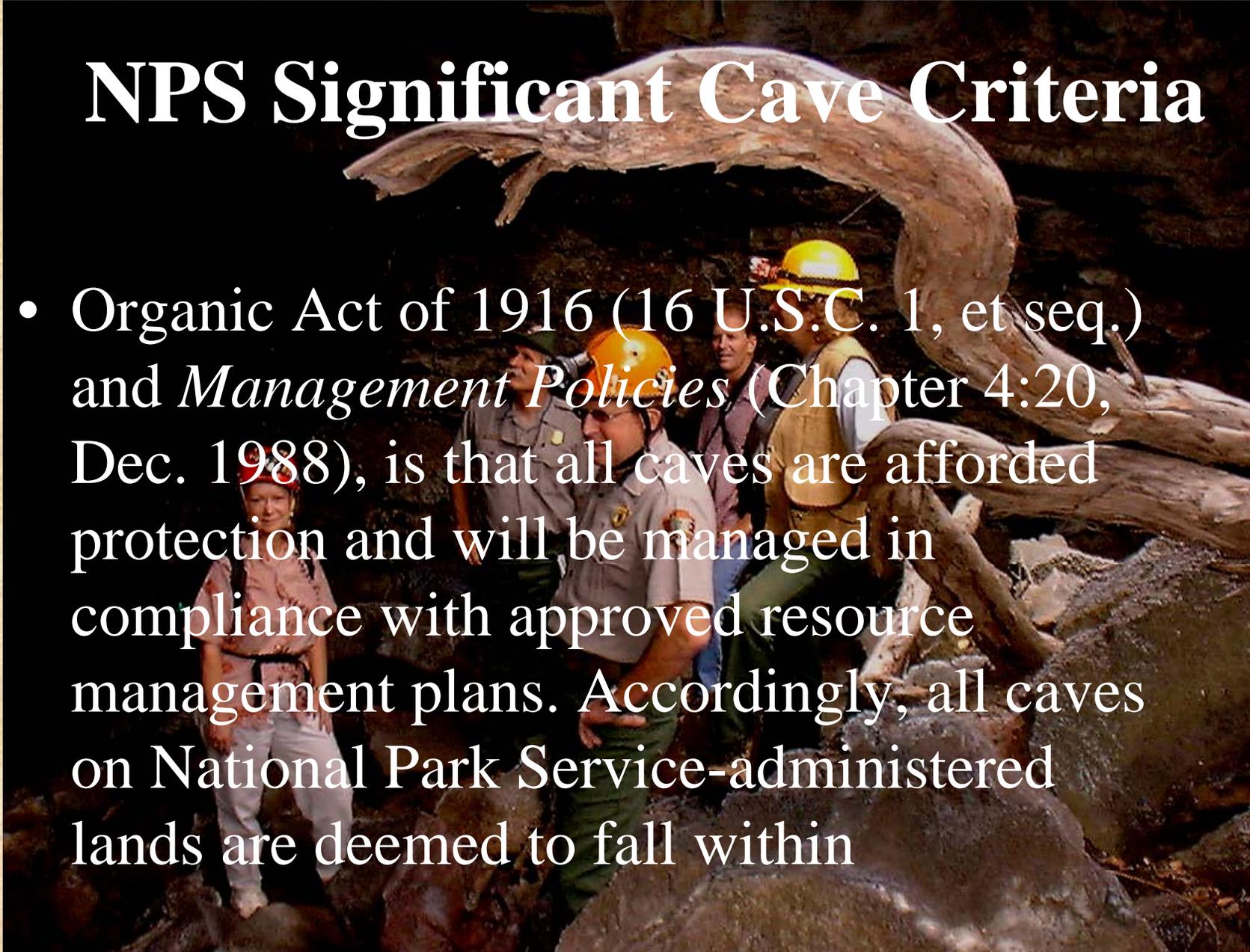
- **Recreational.** The cave provides or could provide recreational opportunities or scenic values.

Significant Cave Criteria- Educational or Scientific

- **Educational or Scientific.** The cave offers opportunities for educational or scientific use; or, the cave is virtually in a pristine state, lacking evidence of contemporary human disturbance or impact; or, the length, volume, total depth, pit depth, height, or similar measurements are notable.



NPS Significant Cave Criteria

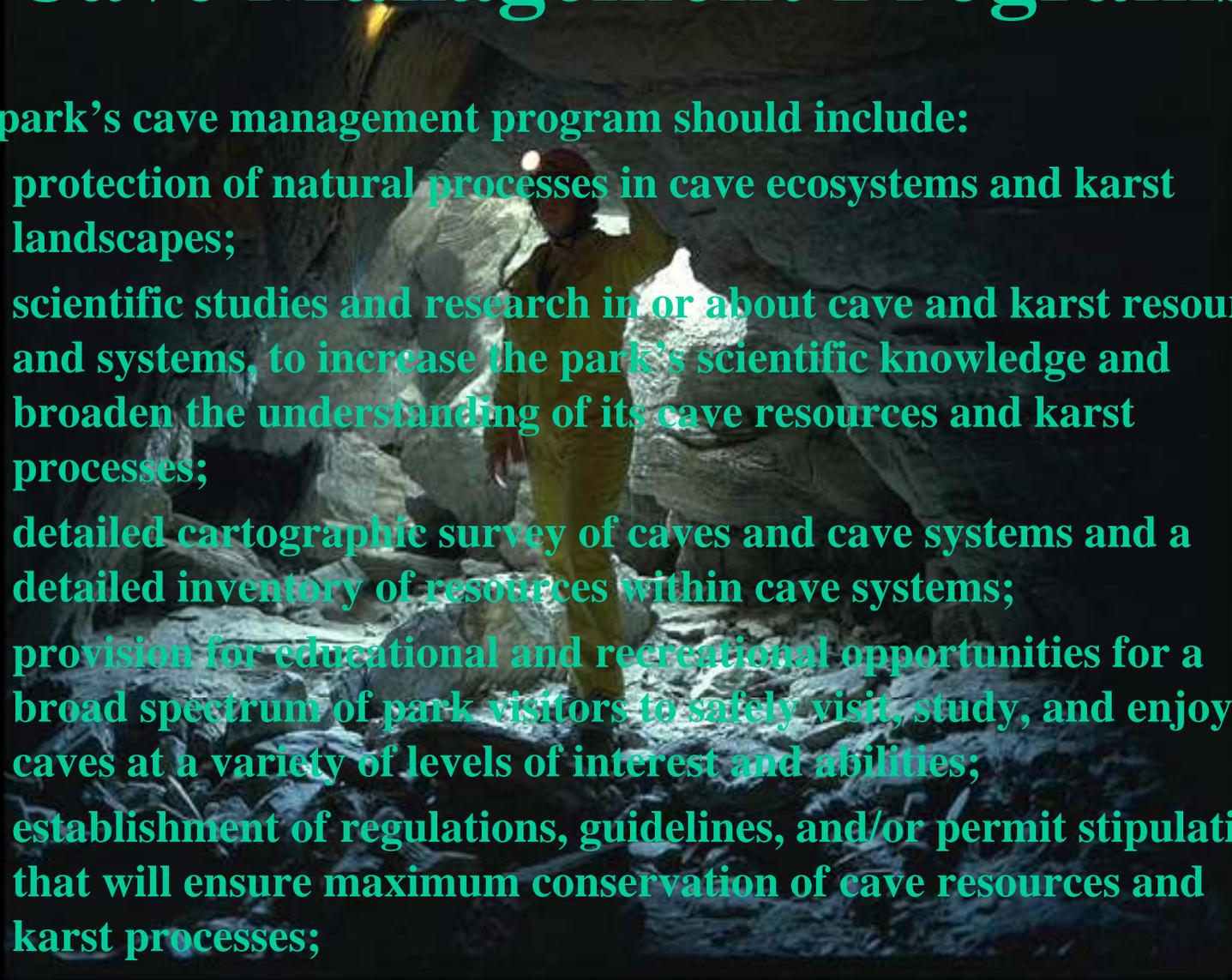


- Organic Act of 1916 (16 U.S.C. 1, et seq.) and *Management Policies* (Chapter 4:20, Dec. 1988), is that all caves are afforded protection and will be managed in compliance with approved resource management plans. Accordingly, all caves on National Park Service-administered lands are deemed to fall within

Cave Management Programs

A park's cave management program should include:

1. protection of natural processes in cave ecosystems and karst landscapes;
2. scientific studies and research in or about cave and karst resources and systems, to increase the park's scientific knowledge and broaden the understanding of its cave resources and karst processes;
3. detailed cartographic survey of caves and cave systems and a detailed inventory of resources within cave systems;
4. provision for educational and recreational opportunities for a broad spectrum of park visitors to safely visit, study, and enjoy caves at a variety of levels of interest and abilities;
5. establishment of regulations, guidelines, and/or permit stipulations that will ensure maximum conservation of cave resources and karst processes;



Cave Management Programs

A person wearing a bright yellow full-body suit and a red helmet is walking away from the viewer into a dark, rocky cave. The person is positioned in the lower center of the frame, with their back to the camera. The cave walls are dark and textured, with some light reflecting off the surfaces. The overall scene is dimly lit, emphasizing the person's bright colors.

5. establishment of regulations, guidelines, and/or permit stipulations that will ensure maximum conservation of cave resources and karst processes;
6. direction for cave restoration activities that remove unnatural materials or restore otherwise impacted areas;
7. establishment of standard operating procedures in the maintenance and upkeep of developed cave passages;
8. monitoring of natural environmental conditions and visitor use and impact;
9. protection of related cultural and biological resources; and methods for sustainable use of cave resources.

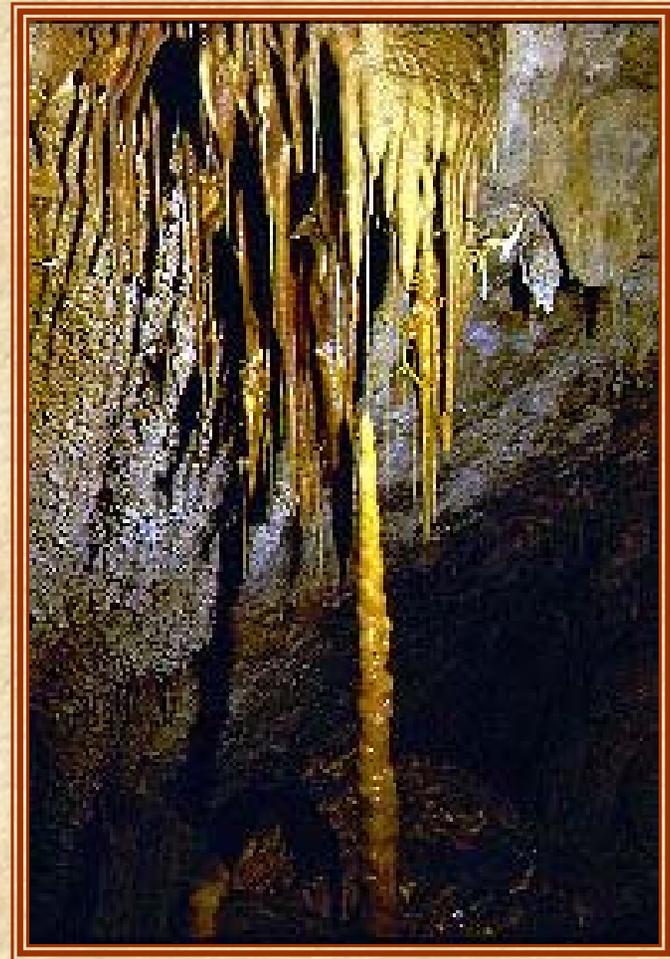
Resources - I

- **Biological resources include (but are not limited to)**
- **several species of endangered bats,**
- **ferns and lichens (in cave entrance ecotones),**
- **cave adapted fish, salamanders, and**
- **invertebrates (about which we know so little. We are currently unable to evaluate population stability, impacts from current and past human activities, nor the probabilities for species survival.)**



Resources - II

- **Other resources range from ancient torch smudges on cave ceilings to civil war age saltpeter vats used to make gun powder.**
- **pack rat middens in Grand Canyon caves that yielded pollen as old as 4000 years.**



Resources - III

- **Cave-dwelling organisms have specialized adaptations such as extreme longevity and enhanced sensory perceptions.**
- **The adaptations reveal much about the evolutionary responses to past environmental changes and may provide valuable clues to current climate change**



National Cave and Karst Research Institute

- **The National Cave and Karst Research Institute Act of 1998 (Public Law 105-325) mandated the National Park Service to establish the Institute. The Act stipulated that the Institute will be located in the vicinity of Carlsbad Caverns National Park in New Mexico (but not inside Park boundaries), and that the Institute cannot spend Federal funds without a match of non-Federal funds. The Institute is authorized to carry out its objectives internationally as well as nationally.**

National Cave and Karst Research Institute



- **Mission Statement**
- *"The National Cave and Karst Research Institute furthers the science of speleology by facilitating research, enhances public education, and promotes environmentally sound cave and karst management."*

National Cave and Karst Research Institute

Goals of the National Cave and Karst Research Institute:

- **Further the science of speleology through coordination and facilitation of research.**
- **Provide a point-of-contact for dealing with cave and karst issues by providing analysis and synthesis of speleological information and serving as a repository of information.**
- **Foster partnerships and cooperation in cave and karst research, education, and management programs.**

National Cave and Karst Research Institute

Goals of the National Cave and Karst Research Institute:

- **Promote and conduct cave and karst educational programs.**
- **Promote national and international cooperation in protecting the environment for the benefit of caves and karst landforms and systems.**
- **Develop and promote environmentally sound and sustainable cave and karst management practices, and provide information for applying these practices.**

National Cave and Karst Research Institute



• Current Projects

- Producing an improved national karst map and an associated web-based network of karst information in collaboration with USGS and University, State, and private groups.
- Sponsored publication of three cave related books with Denver Museum of Nature and Science “Vertebrate Paleontology of Pleistocene Cave Deposits in North America,” the National Speleological Society, “Cave Conservation and Restoration.” and a "Handbook for Cave and Karst Management for America's Protected Lands" with the Karst Waters Institute.
- National inventory of microbial DNA in caves with Western Kentucky University Biotechnology Center.

Who is responsible for coordination of NPS cave resource management issues?

- **GRD**

- Staff: National Cave Management Coordinator**

- some project funding available**

- extensive network of contacts**

- **Service Contacts: 21 Cave Specialists Service Wide**

- **Network: Societies and academia**

Cave Statutes

General:

- **NPS Organic Act language**
- **Park enabling acts**

Specific:

- **Park enabling acts**
- **Federal Cave Resources Protection Act of 1988**
- **16 USC 4310 (1990)**
- **Lechuguilla Cave Protection Act of 1993**
- **National Cave & Karst Research Institute Act of 1998**

2001 NPS Management Policies

Chapter 4:

4.8.1.2 Karst (see page 42)

- maintain integrity
- mitigate impacts

4.8.2.2 Caves (see page 43)

- protect
- remove inappropriate
development if impairing

Chapter 6:

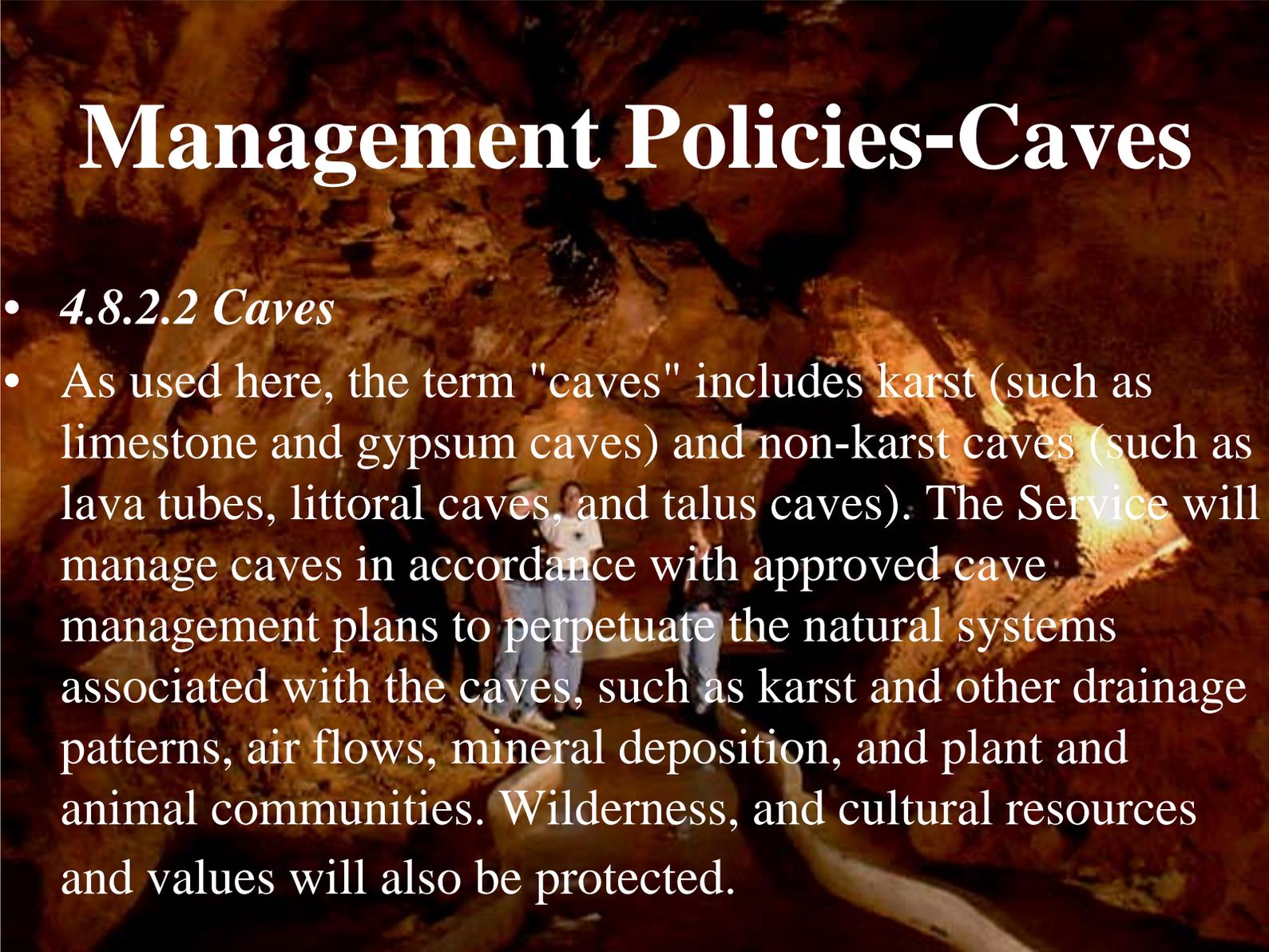
6.3.11.2 Caves (see page 69)

- manage as wilderness

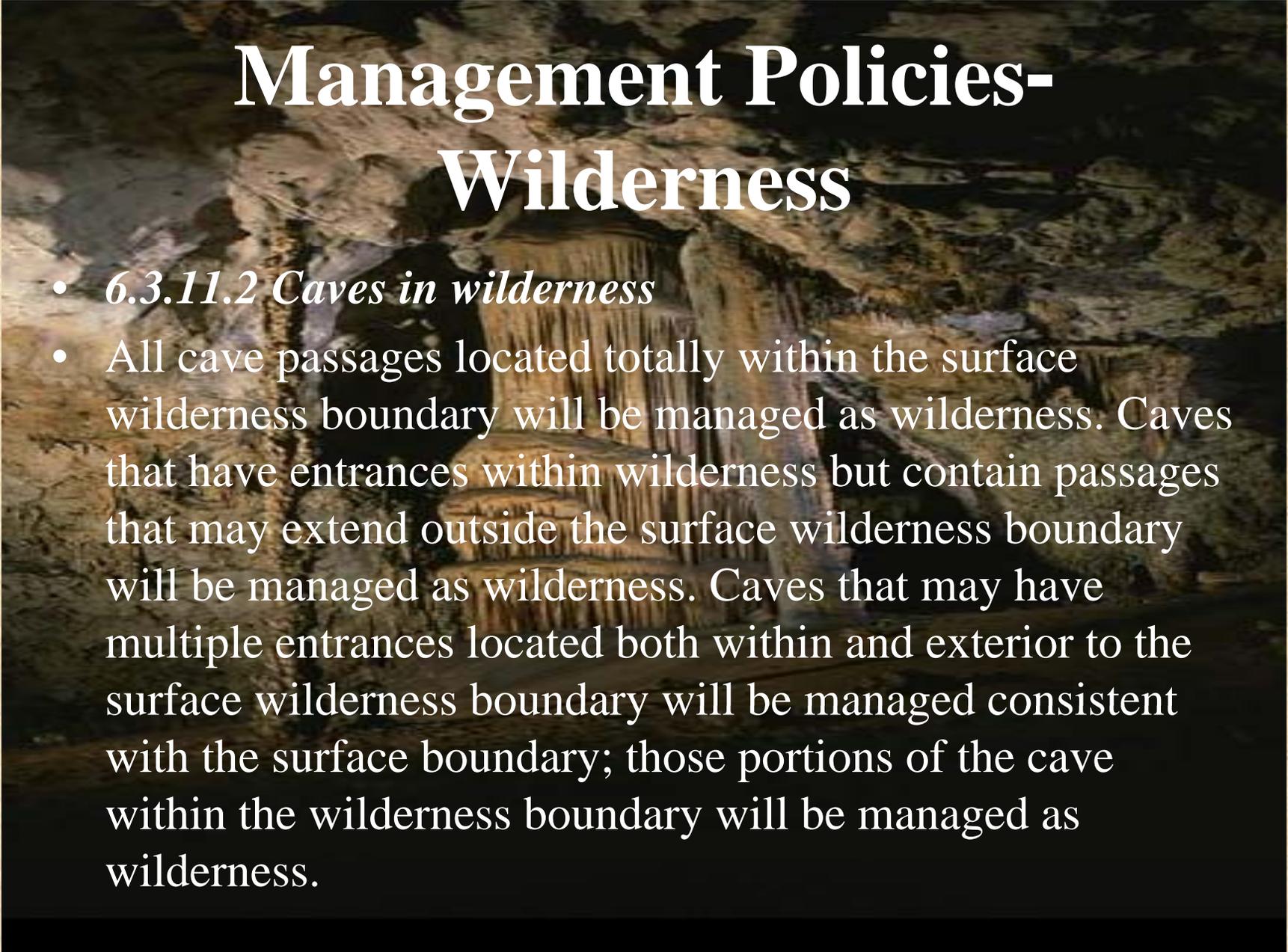
Management Policies-Karst

- *4.8.1.2 Karst*
- The Service will manage karst terrain to maintain the inherent integrity of its water quality, spring flow, drainage patterns, and caves. Karst processes (the processes by which water dissolves soluble rock such as limestone) create areas typified by sinkholes, underground streams, caves, and springs.
- Local and regional hydrological systems resulting from karst processes can be directly influenced by surface land use practices. If existing or proposed developments do or will significantly alter or adversely impact karst processes, these impacts will be mitigated. Where practicable, these developments will be placed where they will not have an effect on the karst system.

Management Policies-Caves

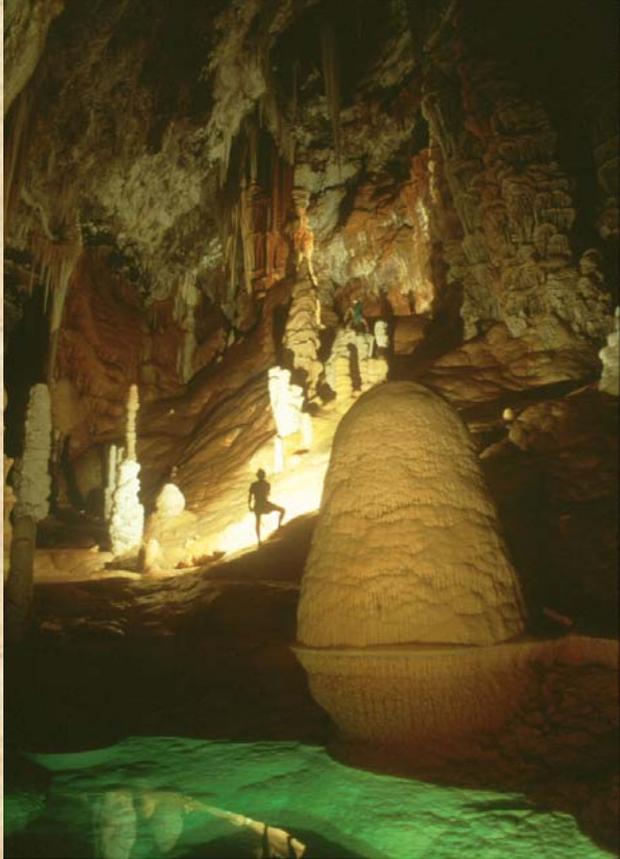
A photograph of a cave interior, showing a path with people walking. The cave walls are dark and textured, and the lighting is dim, highlighting the natural formations.

- *4.8.2.2 Caves*
- As used here, the term "caves" includes karst (such as limestone and gypsum caves) and non-karst caves (such as lava tubes, littoral caves, and talus caves). The Service will manage caves in accordance with approved cave management plans to perpetuate the natural systems associated with the caves, such as karst and other drainage patterns, air flows, mineral deposition, and plant and animal communities. Wilderness, and cultural resources and values will also be protected.

A photograph of a cave interior. In the center, a waterfall flows down a rocky ledge. The cave walls are covered in various rock formations, including stalactites and stalagmites. The lighting is dim, highlighting the textures of the rock.

Management Policies- Wilderness

- *6.3.11.2 Caves in wilderness*
- All cave passages located totally within the surface wilderness boundary will be managed as wilderness. Caves that have entrances within wilderness but contain passages that may extend outside the surface wilderness boundary will be managed as wilderness. Caves that may have multiple entrances located both within and exterior to the surface wilderness boundary will be managed consistent with the surface boundary; those portions of the cave within the wilderness boundary will be managed as wilderness.



MANAGING THE
CAVE
ENVIRONMENT IN
LIGHT OF NEW
ECOLOGICAL
UNDERSTANDINGS

By Dale Pate
Cave Resources Specialist
Carlsbad Caverns National Park

LECHUGUILLA CAVE

- Brief History
 - Discovery
 - Early Management
- Environment Types
- Human Impacts
- Microbial Studies
- Management Actions



Lechuguilla Cave

- Before May 1986
- Breakthrough
- 1986 to 1992
- After 1993

Length – 105 miles

Temp. - @ 68 degrees F.

Humidity – 100%

Total Darkness



VARIED & UNIQUE TYPES OF ENVIROMENTS

SUB-AQUEOUS
HELICTITES





LAKES & POOLS



CALCITE ENCRUSTED ORGANIC
MATERIALS



MASSIVE SULFUR & GYPSUM DEPOSITS

GYPSUM CHANDELIERS



HUMAN IMPACTS



FOOTPRINTS



DIVING IN
LAKE OF THE
BLUE GIANTS
& OTHER
DEEP POOLS





CAMPING IN THE CAVE

GEAR & EQUIPMENT STASHES



MICROBIAL STUDIES



- Native Microbe Identification
- Medicinal Values
- Human Impacts
- NASA - Life on Mars

MANAGEMENT ACTIONS

- Strict Access Policies
- Written Guidelines
- Practice Minimal Impact Techniques
 - Delineate Permanent Trails
 - Keep Away From Pools
- Monitor Compliance to Guidelines
- Human Impact Study
- Promote Additional Research

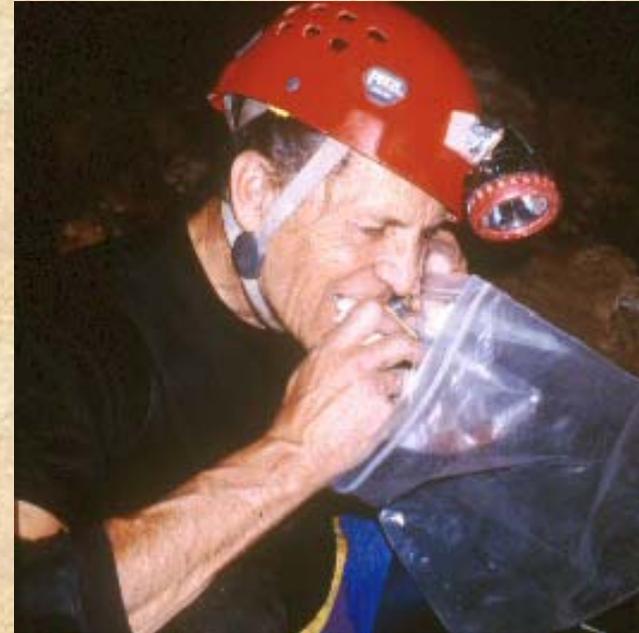
Develop Guidelines

APPENDIX F: GUIDELINES FOR ENTERING LECHUGUILLA CAVE

* The reason behind developing guidelines for entering Lechuguilla Cave is to allow limited access for scientific research, survey when in association with exploration, and NPS management related trips while impacting the cave as little as possible. Of primary importance are the (1) impacts to the cave and (2) the safety of all who enter.

BEFORE ENTERING CAVE

- * Everyone **must** sign a permit.
- * Expedition leaders are ultimately responsible for the personnel on their expedition. Expedition leaders should do their best to recruit cavers that are willing to follow the guidelines that have been established. Before assigning anyone to the Far East, a Expedition leader should be reasonably sure that individual is fully prepared for such a trip.
- * Every team entering the cave will have one designated team leader. Team leaders have tremendous responsibilities. They are responsible for the safety of their team and for the actions of their team members. If a team member is acting in an unsafe manner or not being careful and actually causing more damage to the cave, then it is the team leader's responsibility to correct that persons actions. If problems persist, then the team leader must abort the trip and have the team leave the cave. A team leader should gear team activities to the least experienced member of the team. This pertains to speed of travel as well as climbing leads. A team should also stay together unless an emergency requires different actions.
- * Everyone entering the cave is responsible for their actions while in the cave. They are also responsible for reporting to the team leader acts by other team members that are unsafe or damaging to the cave. The overall goal is to allow limited access to the cave while minimizing all impacts. It is everyone's responsibility to assure that Lechuguilla Cave remains as pristine as possible and that each team member is very safety aware while in the cave.
- * Clothing, boots, and caving gear should be clean before entering the cave to minimize the introduction of foreign bacteria, molds, and fungus into this unique ecosystem.
- * **BOOTS MUST HAVE NON-MARKING SOLES.** If you are in doubt, scrape boot over white floor or limestone rocks. Marking boots will definitely leave marks.
- * Using a frame pack in the cave can be a problem and a major nuisance. It is recommended that these **NOT** be used.
- * Electric lights are a must. No carbide lights or open-flame lights will be allowed in Lechuguilla. One of the reasons for this is safety, because of the flammability of the massive sulfur deposits found in the cave.





Establish & Maintain
Permanent Flagged Trail

Stay Away From Pools



Conduct Human Impact Study









Thanks to everyone involved with the scientific study of Lechuguilla Cave.

Thanks to the following for the use of their photos: Gosia Allison-Kosior, Stan Allison, Peter & Ann Bosted, John Brooks, Dave Bunnell, Dave Harris, Louise Hose, Jason Richards, Norm Thompson, Val Werker.

