NATIONAL PARK SERVICE • U.S. DEPARTMENT OF THE INTERIOR

Foundation Document

Jewel Cave National Monument

South Dakota

February 2016


BLACK HILLS
NATIONAL FOREST
To Custer
16
Historic Area
summer only
Historic Lantern Tour
JEWEL CAVE
NATIONAL MONUMENT
CANYON
To Newcastle, Wyo.
16
LITHOGRAPH
HELL
Visitor Center
Discovery, Scenic and Wild Caving Tours
CANYON
North
0
0.5 Kilometer
0
0.5 Mile
Information about hiking trails is available at the Visitor Center.
Information
Parking
Picnic area

Contents

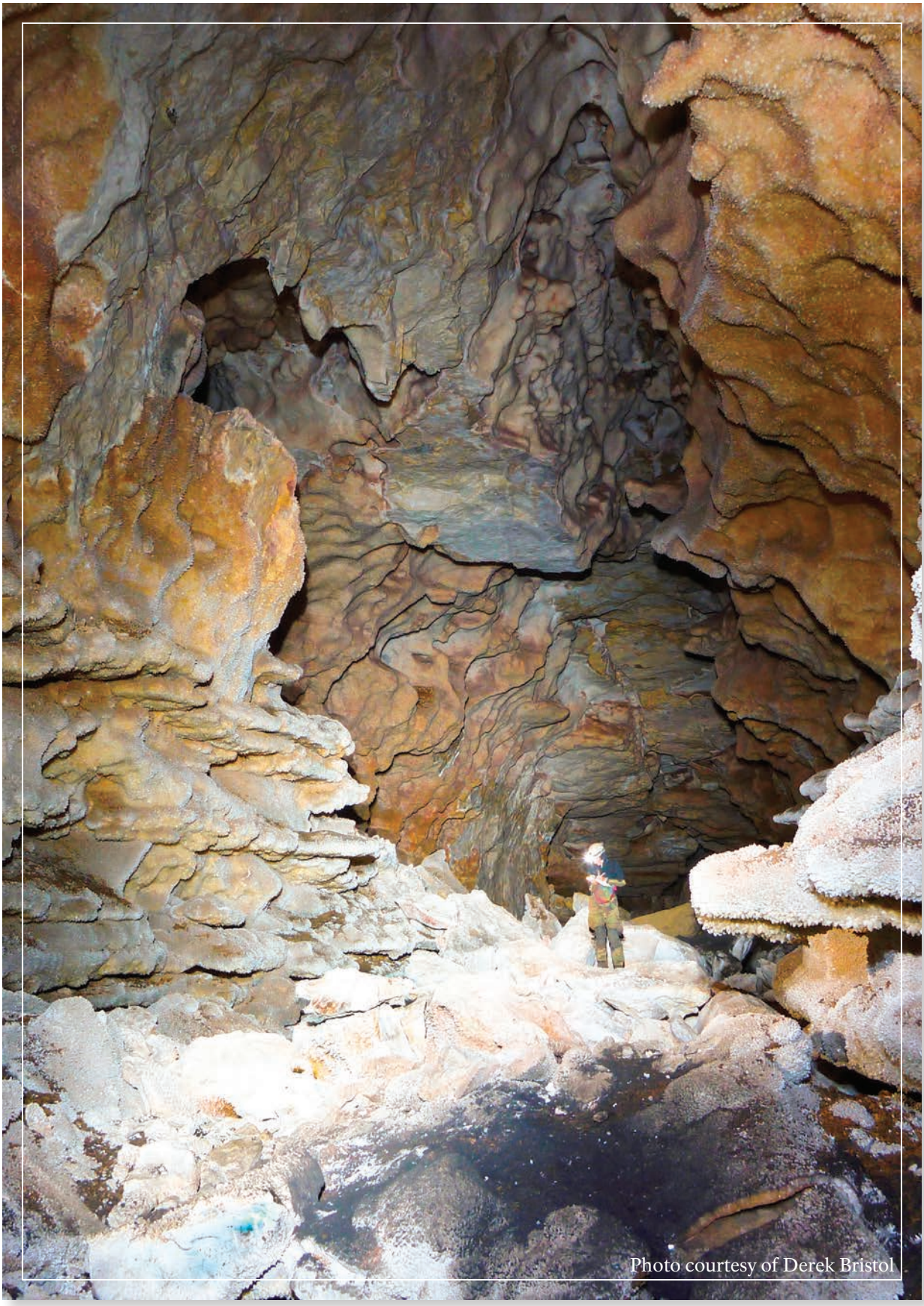


Photo courtesy of Derek Bristol

Mission of the National Park Service

The National Park Service (NPS) preserves unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of this and future generations. The National Park Service cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world.

The NPS core values are a framework in which the National Park Service accomplishes its mission. They express the manner in which, both individually and collectively, the National Park Service pursues its mission. The NPS core values are:

- **Shared stewardship:** We share a commitment to resource stewardship with the global preservation community.
- **Excellence:** We strive continually to learn and improve so that we may achieve the highest ideals of public service.
- **Integrity:** We deal honestly and fairly with the public and one another.
- **Tradition:** We are proud of it; we learn from it; we are not bound by it.
- **Respect:** We embrace each other's differences so that we may enrich the well-being of everyone.

The National Park Service is a bureau within the Department of the Interior. While numerous national park system units were created prior to 1916, it was not until August 25, 1916, that President Woodrow Wilson signed the National Park Service Organic Act, formally establishing the National Park Service.

The national park system continues to grow and comprises over 400 park units covering more than 84 million acres in every state, the District of Columbia, American Samoa, Guam, Puerto Rico, and the Virgin Islands. These units include, but are not limited to, national parks, monuments, battlefields, military parks, historical parks, historic sites, lakeshores, seashores, recreation areas, scenic rivers and trails, and the White House. The variety and diversity of park units throughout the nation require a strong commitment to resource stewardship and management to ensure both the protection and enjoyment of these resources for future generations.

The arrowhead was authorized as the official National Park Service emblem by the Secretary of the Interior on July 20, 1951. The sequoia tree and bison represent vegetation and wildlife, the mountains and water represent scenic and recreational values, and the arrowhead represents historical and archeological values.

Introduction

Every unit of the national park system will have a foundation document to provide basic guidance for planning and management decisions—a foundation for planning and management. The core components of a foundation document include a brief description of the park, as well as the park's purpose, significance, fundamental resources and values, other important resources and values, and interpretive themes. The foundation document also includes special mandates and administrative commitments, an assessment of planning and data needs that identifies planning issues, planning products to be developed, and the associated studies and data required for park planning. Along with the core components, the assessment provides a focus for park planning activities and establishes a baseline from which planning documents are developed.

A primary benefit of developing a foundation document is the opportunity to integrate and coordinate all kinds and levels of planning from a single, shared understanding of what is most important about the park. The process of developing a foundation document begins with gathering and integrating information about the park. Next, this information is refined and focused to determine what the most important attributes of the park are. The process of preparing a foundation document aids park managers, staff, and the public in identifying and clearly stating in one document the information that is necessary for park management to consider when determining future planning efforts, outlining key planning issues, and protecting those resources and values that are integral to park purpose and identity.

While not included in this document, a park atlas is also part of the foundation project. The atlas is a series of maps compiled from available geographic information system (GIS) data on natural and cultural resources, visitor use patterns, facilities, and other topics. It serves as a GIS-based support tool for planning and park operations. The atlas is published as a (hard copy) paper product and as geospatial data for use in a web mapping environment. The park atlas for Jewel Cave National Monument can be accessed online at: http://insideparkatlas.nps.gov/.

Part 1: Core Components

The core components of a foundation document include a brief description of the park, park purpose, significance statements, fundamental resources and values, other important resources and values, and interpretive themes. These components are core because they typically do not change over time. Core components are expected to be used in future planning and management efforts.

Brief Description of the Park

President Theodore Roosevelt established Jewel Cave National Monument by presidential proclamation on February 7, 1908. It was the first national monument established for the protection and preservation of a cave. Following reorganization of the executive branch agencies in 1933, management of Jewel Cave National Monument passed to the National Park Service.

Jewel Cave National Monument is well known for its spectacular and unusual cave and karst features. Since 1959, cavers have made a concerted effort to map Jewel Cave and have discovered that it is among the longest cave systems in the world. Scientific studies indicate that the current exploration / cave survey represents only a fraction of what remains to be found. With an active exploration program, more than 175 miles of passages have been surveyed and mapped. As a result, it was discovered that more than 50% of the cave lies outside the surface boundaries of the park.

The earliest discovery of Jewel Cave was recorded in a mining claim filed by Frank and Albert Michaud in 1900. The brothers described the entrance as a hole that was too small for human entry, with a blast of cold air coming out. After subsequent enlargement with dynamite, they entered the cave with Charles Bush, a friend of the family, discovering crawlways and low-ceilinged rooms coated with beautiful calcite crystals that sparkled like “jewels” in their lantern light.

Most of the cave was formed by slowly circulating, acid-rich groundwater. Its unique story begins with the geologic history of the Black Hills. The oldest rocks in South Dakota's Black Hills are Precambrian-era igneous and metamorphic rocks, which formed under heat and pressure more than two billion years ago. Currently, two cave passages are known to intersect the Madison Aquifer, forming subterranean lakes.

A variety of speleothems (a secondary mineral deposit) are found in the cave, including calcite crystals, calcite rafts, cave popcorn, dripstone, frostwork, gypsum formations, helictites, hydromagnesite balloons, and popcorn stalagmites. Boxwork (a speleogen) and manganese (a chemical element usually found with iron) are also present.

Many large animals move through the park from the surrounding Black Hills National Forest, including white-tailed and mule deer, bighorn sheep, elk, and mountain lions. The cave serves as the largest known bat hibernaculum (a winter roost for hibernation) in South Dakota and is the largest known hibernaculum in the world for Townsend's big-eared bats and threatened Northern long-eared bats.

Archeological sites in the park have been dated up to 5,000 years ago; however, prehistoric use of this area of the Black Hills is known to date to as much as 10,000 years ago. The park preserves prehistoric and historic records of, and resources related to, human activities. The Black Hills region remains highly significant to many American Indian tribes.

The historic ranger station is listed in the National Register of Historic Places, while the trail and cave entrance are in the List of Classified Structures. These properties are in the area defined as the Jewel Cave historic area. The district occupies approximately 158 acres in the northwest portion of the park. The ranger cabin, trail, and current cave entrance were developed from 1937 to 1944. The landscape retains a high level of integrity related to the natural system of the cave, spatial organization, land use, circulation, topography, vegetation in the overall district, and views. Contributing features in the district include the ranger cabin, upper and lower trails to the cave entrance, stone stairway, metal railing, cave entrance area, views to and from the cave entrance, historic area entrance road, Michaud archeological site, manhole, remnants of a trail west of the ranger cabin, ponderosa pine vegetation community, a portion of Highway 16, building foundation remnants in Hell Canyon, fireplace remnants in Hell Canyon, Hell Canyon Road, Civilian Conservation Corps (CCC) constructed cistern, and the site of the former NPS campground. The historic entrance to the cave is at the base of a cliff on the east wall of the canyon, about 70 feet above the canyon floor.

The park's museum collection is mainly devoted to natural resource specimens. It also includes archival materials related to Jewel Cave and early mining, development, and tourism; historic objects and archival materials related to cave exploration, mapping, and surveying; objects and archival materials related to park history; biological specimens and associated field records; and geological specimens and associated field records. The collections, which contain more than 13,000 items, were moved to the Mount Rushmore curatorial storage facility in 2000.

Jewel Cave National Monument is 13 miles west of Custer, South Dakota, and 24 miles east of Newcastle, Wyoming, on US Highway 16. It is about 53 miles from Rapid City, South Dakota, via US Highway 16. The nearest major airport is in Rapid City.

Park Purpose

The purpose statement identifies the specific reason(s) for establishment of a particular park unit. The purpose statement for Jewel Cave National Monument was drafted through a careful analysis of its enabling legislation and the legislative history that influenced its development. Jewel Cave National Monument was established by presidential proclamation on February 7, 1908 (see appendix A for presidential proclamation). The purpose statement lays the foundation for understanding what is most important about Jewel Cave National Monument.

The purpose of Jewel Cave National Monument is to preserve, protect, and interpret one of the last great frontiers by managing and exploring an expansive cave system and the overlying surface for continued scientific and personal interest, and for inspiring public discovery.

Park Significance

Significance statements express why a park's resources and values are important enough to merit designation as a unit of the national park system. These statements are linked to the purpose of Jewel Cave National Monument, and are supported by data, research, and consensus. Statements of significance describe the distinctive nature of the park and why an area is important within a global, national, regional, and systemwide context. They focus on the most important resources and values that will assist in park planning and management.

The following significance statements have been identified for Jewel Cave National Monument. (Please note that the sequence of the statements does not reflect the level of significance.)

1. Jewel Cave represents a pristine and relatively unchanged underground environment featuring subterranean lakes, unusual speleothems, and abundant calcite spar.

2. The cave's extensive length, three-dimensional complexity, prominent barometric wind, and single natural entrance define its unique nature.

3. Scientific research has shown that most of the cave is yet to be discovered, creating opportunities for exploration and new scientific knowledge.

4. Jewel Cave National Monument provides important surface and subsurface habitat for wildlife and nine species of bats, including one of the largest known hibernacula for the Townsend's big-eared bat and the threatened Northern long-eared bat.

Fundamental Resources and Values

Fundamental resources and values (FRVs) are those features, systems, processes, experiences, stories, scenes, sounds, smells, or other attributes determined to warrant primary consideration during planning and management processes because they are essential to achieving the purpose of the park and maintaining its significance. Fundamental resources and values are closely related to a park's legislative purpose and are more specific than significance statements.

Fundamental resources and values help focus planning and management efforts on what is truly significant about the park. One of the most important responsibilities of NPS managers is to ensure the conservation and public enjoyment of those qualities that are essential (fundamental) to achieving the purpose of the park and maintaining its significance. If fundamental resources and values are allowed to deteriorate, the park's purpose and/or significance could be jeopardized.

The following fundamental resources and values have been identified for Jewel Cave National Monument:

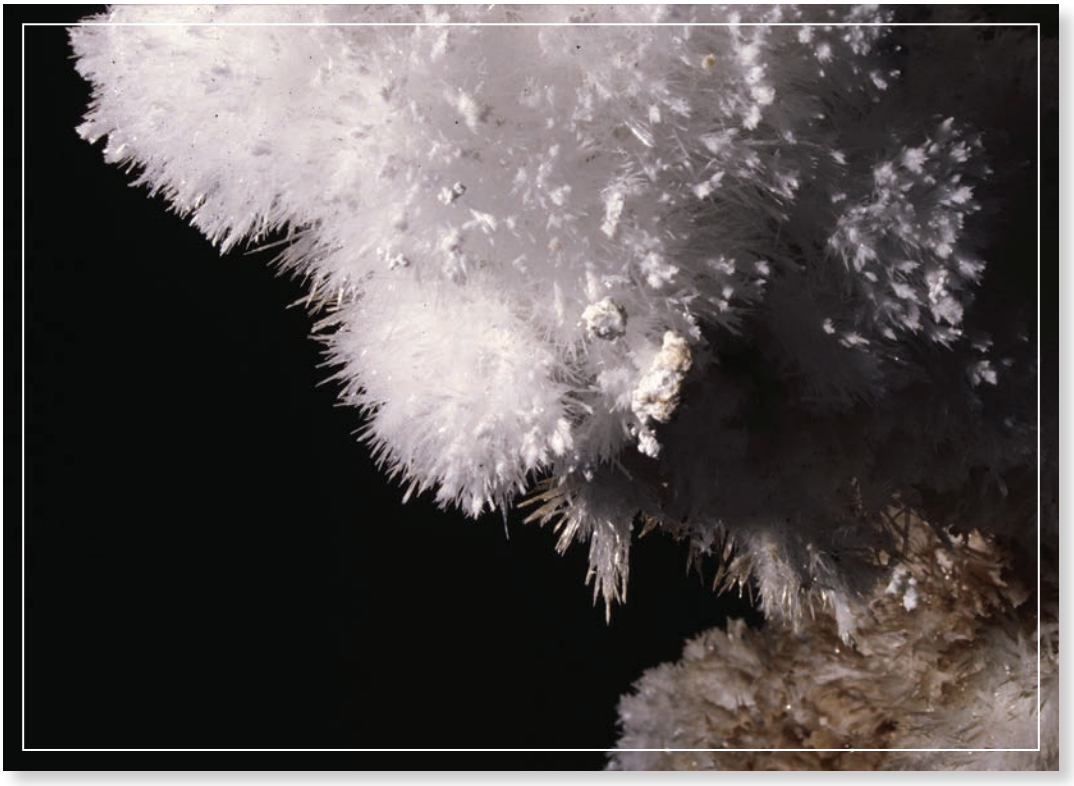
- **Jewel Cave –** This includes the entire cave system and its features, including developed, undeveloped, and as yet undiscovered areas; the cave environment itself, including air flow, water flow, temperature, and scenery; subterranean lakes; and the overlying karst landscape and its geophysical features.
- **Opportunity for Exploration and Discovery in the Cave –** Providing opportunities to experience the cave and facilitates further discovery.
- **Opportunities for Scientific Research –** Scientific interest has influenced the development of the park. Long-term research datasets allow unique opportunities to monitor the condition of resources over time. Continued scientific research in the park increases the ability to understand, interpret, and protect the resources, and contributes to the broader fields of geoscience and climate change.
- **Natural Processes –** Natural conditions and processes prevail on the surface of the cave. Fire and wildlife are managed as lightly as possible while providing protection for cave resources, park staff, visitors, and facilities.

Other Important Resources and Values

Jewel Cave National Monument contains other resources and values that are not fundamental to the purpose of the park and may be unrelated to its significance, but are important to consider in planning processes. These are referred to as "other important resources and values" (OIRV). These resources and values have been selected because they are important in the operation and management of the park and warrant special consideration in park planning.

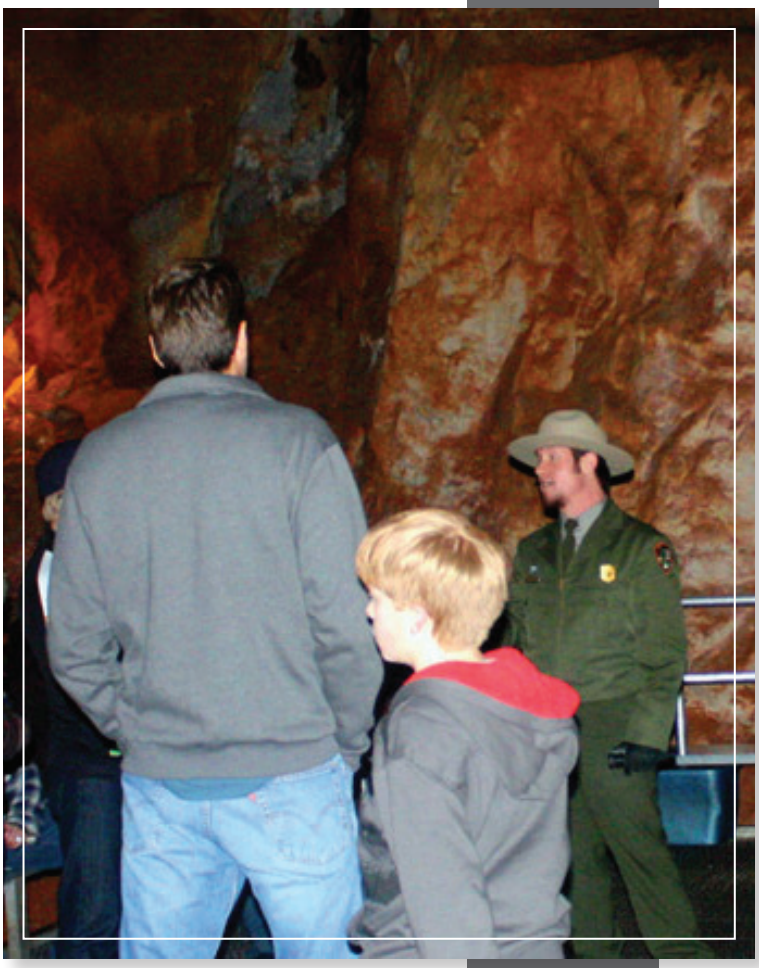
The following other important resources and values have been identified for Jewel Cave National Monument:

- **Cultural Resources –** Resources including the historic ranger cabin, the historic cave entrance, the site of historic Jewel Cave Hotel, Mission 66 buildings, and archeological resources present in the park.
- **Night Sky –** Because of the park's location in the Black Hills away from major sources of light pollution, the park is a place where visitors can experience exceptionally clear night skies.
- **Museum Collection –** The museum collection contains more than 13,000 items, including a herbarium, insect collection, and small mammal collection. It also includes archival materials related to Jewel Cave and early mining, development, and tourism; historic objects and archival materials related to cave exploration, mapping, and surveying; and objects and archival materials related to the park's history. The collection also includes field records for both surface and subsurface research. Any collection items not on display are housed in the multipark collection storage facility at Mount Rushmore National Memorial.



Interpretive Themes

Interpretive themes are often described as the key stories or concepts that visitors should understand after visiting a park—they define the most important ideas or concepts communicated to visitors about a park unit. Themes are derived from, and should reflect, park purpose, significance, resources, and values. The set of interpretive themes is complete when it provides the structure necessary for park staff to develop opportunities for visitors to explore and relate to all park significance statements and fundamental and other important resources and values.



Interpretive themes are an organizational tool that reveal and clarify meaning, concepts, contexts, and values represented by park resources. Sound themes are accurate and reflect current scholarship and science. They encourage exploration of the context in which events or natural processes occur and the effects of those events and processes. Interpretive themes go beyond a mere description of the event or process to foster multiple opportunities to experience and consider the park and its resources. These themes help explain why a park story is relevant to people who may otherwise be unaware of connections they have to an event, time, or place associated with the park. Interpretive themes may be modified and new themes developed over time as new information comes to light and/or new visitor experiences become available.

The following interpretive themes have been identified for Jewel Cave National Monument:

- Jewel Cave provides a portal into one of the last undisturbed worlds on Earth where curiosity and desire for new experiences can lead to adventure, learning, and personal achievement.
- Scientific research of the geologically young Jewel Cave continues to bring new insight and revelation while posing new questions after each discovery.
- Exploration in Jewel Cave reflects a long-standing and deeply seated human desire to venture beyond physical and intellectual frontiers.
- Immersion in the subtle beauty and mystery in the complex underground world of Jewel Cave can bring forth awe, wonder, fascination, and anticipation.
- The entwined natural resources of the park reveal connections and conditions that foster a deeper understanding and appreciation of the delicate relationship between surface and subsurface features.
- The park stands as a pristine island in the diverse, unique ecosystem of the Black Hills where east meets west and habitats remain intricately linked together.

Part 2: Dynamic Components

The dynamic components of a foundation document include special mandates and administrative commitments and an assessment of planning and data needs. These components are dynamic because they will change over time. New special mandates can be established and new administrative commitments made. As conditions and trends of fundamental and other important resources and values change over time, the analysis of planning and data needs will need to be revisited and revised, along with key issues. Therefore, this part of the foundation document will be updated accordingly.

Special Mandates and Administrative Commitments

Many management decisions for a park unit are directed or influenced by special mandates and administrative commitments with other federal agencies, state and local governments, utility companies, partnering organizations, and other entities. Special mandates are requirements specific to a park that must be fulfilled. Mandates can be expressed in enabling legislation, in separate legislation following the establishment of the park, or through a judicial process. They may expand on park purpose or introduce elements unrelated to the purpose of the park. Administrative commitments are, in general, agreements that have been reached through formal, documented processes, often through memorandums of agreement. Examples include easements, rights-of-way, arrangements for emergency service responses, etc. Special mandates and administrative commitments can support, in many cases, a network of partnerships that help fulfill the objectives of the park and facilitate working relationships with other organizations. They are an essential component of managing and planning for Jewel Cave National Monument. At this time Jewel Cave National Monument does not have any special mandates.

Administrative Commitments

- 1989 Mineral Withdrawal (2,387.44 acres) – Adjacent to west, south, and east park boundaries. Expired in 2009. It is in the process of being renewed and should be signed in 2015. (A mineral withdrawal essentially closes an area of federal public lands to mining, subject to valid existing rights.) This is important to protect the cave passages, which extend outside the park's surface boundary.
- 2008 Mineral Withdrawal (4,595.78 acres) – Southeast of the park, adjacent to south and east boundaries of the 1989 withdrawal. Expires in 2028. This is important to protect the cave passages that extend outside the park's surface boundary.
- Highway Right-of-Way – Highway easement deed with South Dakota Department of Transportation for maintenance of US Highway 16, the only access to the park. Finalized in 2014.
- Water rights for two water wells, to service the park and the public. They were drilled after the park was established to meet the needs of park development.

- Service First Mutual Assistance Memorandum of Understanding (May 2013). The Service First statute (section 330 of the Department of the Interior and Related Agencies Appropriations Act of 2001, Public Law No. 106-291, 114 Stat. 996, 43 USC 1701 note, as amended by section 428 of the Department of the Interior, Environment, and Related Agencies Appropriations Act of 2006, Public Law No. 109-54, 119 Stat. 555, as further amended and extended through September 30, 2011, under section 418 of the Omnibus Appropriations Act of 2009, Public Law No. 111-8, and as further amended and extended through fiscal year 2012 and each fiscal year thereafter under section 422 of the Consolidated Appropriations Act of 2012, Public Law No. 112-74. 3) authorizes agencies to conduct shared or joint management activities to achieve mutually beneficial resource management goals to improve customer service, increase operational efficiencies, and improve land management across jurisdictional boundaries. The agreement is nonfund-obligating and expires in 2018. Agencies involved include: Jewel Cave National Monument, Wind Cave National Park, Black Hills National Forest (Hell Canyon Ranger District), and Nebraska National Forests and Grasslands (Fall River Ranger District).
- US Forest Service (USFS) Interagency Agreement for the National Park Service to manage Jewel Cave outside NPS boundaries and under USFS lands (2011). Addresses the fact that nearly 50% of the known passages lie outside the NPS park boundaries.
- USFS Special Use Permit allowing Jewel Cave National Monument to maintain the two detention ponds just outside the park boundary on USFS land. The detention ponds contain hydrocarbon runoff filters and the National Park Service will maintain them, including periodic replacement of Smart Sponges® to ensure that Highway 16 runoff is petroleum-free before entering the cave below.

Assessment of Planning and Data Needs

Once the core components of part 1 of the foundation document have been identified, it is important to gather and evaluate existing information about the park's fundamental and other important resources and values, and develop a full assessment of the park's planning and data needs. The assessment of planning and data needs section presents planning issues, the planning projects that will address these issues, and the associated information requirements for planning, such as resource inventories and data collection, including GIS data.

There are three sections in the assessment of planning and data needs:

1. analysis of fundamental resources and values
2. identification of key issues and associated planning and data needs
3. identification of planning and data needs (including spatial mapping activities or GIS maps)

The analysis of fundamental resources and values, and identification of key issues leads up to and supports the identification of planning and data collection needs.

Analysis of Fundamental Resources and Values

The fundamental resource or value analysis table includes current conditions, potential threats and opportunities, planning and data needs, and selected laws and NPS policies related to management of the identified resource or value. (Please see appendix B for a list of laws and NPS policies.)

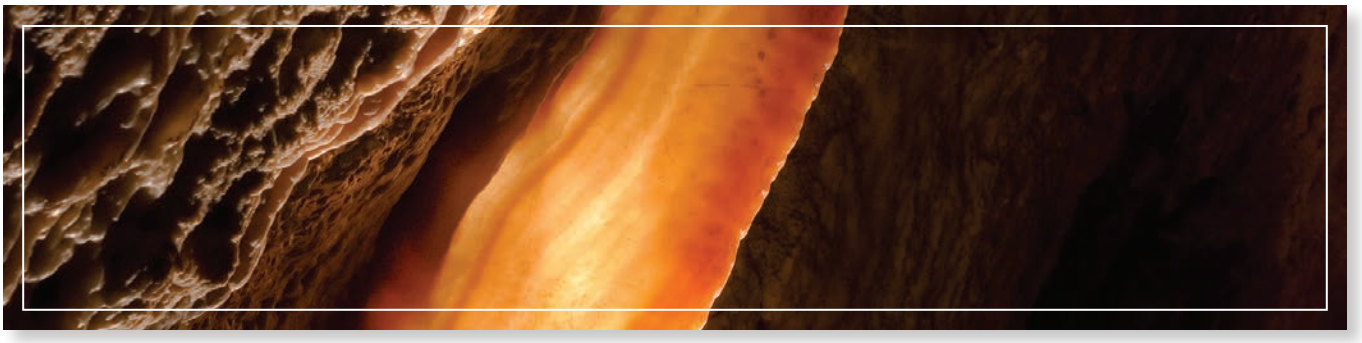
Fundamental Resource or Value	Jewel Cave
Related Significance Statements	All.
Current Conditions and Trends	**Conditions** • Discovered portion of the cave has been surveyed and mapped. • The discovered portion of the cave has not been completely inventoried. There are large data gaps; therefore, meaningful GIS analysis of cave features is currently impossible. • Half of the known cave lies outside the surface boundary of the park (97% of the probable full extent of the cave). • There are safety concerns with the aged tour structures (metal railings, platforms, and steps). • The noise from use of the tour structures and the buzzing of mercury vapor lights impairs the natural soundscape of silence in the cave. • Dust and lint that accumulates annually from visitors is localized in tour areas; lint tarps do not fit well and cleaning them is a time-intensive process. A redesign is needed so they can be accessed more safely. Dust and lint can impact visitor safety and impact cave aesthetics on the tour route. • Lint collects on formations and is visible in hard-to-reach places. • The light system in the cave is aging and energy inefficient. • Elevators are in good condition. In the mid-1990s, the original elevator was completely rebuilt, and a second elevator was added. The electromechanical control system was replaced by a new computerized system. • The maximum carrying capacity is limited primarily by the space in the cave (to prevent tour groups bumping into each other). The size of the parking lot and staff availability are also limiting factors. • Mineral withdrawal for 2,387.44 acres. The Bureau of Land Management (BLM) manages the mineral rights under USFS ownership. This area is withdrawn because of its sensitivity. This 20-year agreement needs to be renewed. • There is a second mineral withdrawal for 4,595.78 acres. • Karst system is stable and in good condition. • Groundwater use is stable; recharge exceeds withdrawal. A recent scientific study concluded that there is low vulnerability to contamination. • Sediments, speleothems, and speleogens are in good condition; areas with a longer history of use show more wear and damage. • Bat habitat is in good condition. As of this writing, white-nose syndrome is not present among the bat population in the cave. • Nonnative algae (lamp flora), caused by the cave lighting system is minimal and localized to the lighted tour areas of the cave. • Ongoing exploration has added an average of 5 miles a year to the cave's known length. • The cave extends under private land as well as under USFS lands. • Recently discovered subterranean lakes are likely to be pristine and unaffected by human activities. **Trends** • Visitation is on the increase—the cave cannot accommodate the number of visitors and tours are saturated. Under the best conditions, only a certain number of tours can be conducted every day and they are at capacity. • The northern long-eared bat was listed as threatened in April 2015. • Jewel Cave National Monument is participating in an NPS pilot project with the Department of Energy to identify and install energy conservation measures, which may include improved LED cave lighting and HVAC systems and, potentially, photovoltaic systems. • Regional coal-fired power plants, coal mining, and oil and gas development contribute to air quality impacts in the park. The park is to the east of the Powder River Basin, which has seen extensive oil and gas development.

Fundamental Resource or Value	Jewel Cave
Threats and Opportunities	**Threats** • Tour structures need to be upgraded or replaced for safety, resource protection, and efficiency. • Parts for the elevator system are becoming difficult to find due to the age of the system. • Much of the land that overlies Jewel Cave is owned by the US Forest Service; the multiple-use doctrine could lead to activities that generate pollutants that impact the cave interior. • Cow manure could contaminate water that seeps into the cave, which is sometimes used as drinking water by cave explorers. • White-nose syndrome may infect resident bats. • Break-ins at the historic cave entrance can disturb the bats. This is especially dangerous for the bats in winter. • Bats at Jewel Cave National Monument may be susceptible to toxic accumulation given their voracious appetite for insects and their position high on the food chain. • Vandalism such as people scratching their initials on cave walls and breaking calcite crystals occurs. • Threat from septic system seepage or contaminated runoff from development on private lands that overlie the cave. • The varying amounts of radon and other gases in the cave could impact human health. Radon and radon daughter (new radioactive elements due to decay) levels have been measured in most park buildings, along the tour routes, and in some off-trail locations in the cave. The greatest exposure is to cave tour guides, who could spend up to 90 hours a month in the cave. Currently, all human exposure levels are believed to be within public health standards. Animals are not at risk, because they live only near the historic entrance where extensive natural ventilation ensures that radon is at near-atmospheric levels. • An increase in mean annual temperature (+4° to +5° F by 2050) with a slight increase in mean annual precipitation (+7% by 2050) projected for the region, along with increases projected for storm frequency/intensity and droughts due to climate change, could reduce groundwater recharge for the karst system, increase episodic runoff events degrading water quality from flushing of surface contaminates into the karst system and could impact cave temperatures over time. • Commercial traffic on the highway—a truck accident could cause a spill that would sink into the cave. This has been mitigated by softer curves on the road and detention ponds with filtration. • The subterranean lakes are vulnerable to contamination from human activities. • Subterranean lake water levels could be affected by groundwater withdrawals in the Madison Aquifer for water development purposes. The lakes are located outside the park boundary and beyond existing mineral withdrawals. **Opportunities** • Installing a regenerative drive for the elevators. • Use of a photovoltaic system to supply power for the cave lighting system. • Upgrade the elevator system (probably in the next 10 years) for electronics. • Possible cave route changes to accommodate different tours and/or length of tours. • Replacing the tour structures to incorporate more efficient lint-catching systems which would protect resources and reduce annual maintenance. • A weather station outside the cave would collect surface data to compare with cave weather and could be used to monitor climate change. • Analyze what can be done to expand tour routes (although staffing is a limiting factor, but could build capacity with recreation fees). Need to look at resource impacts. There could be a way to accommodate changing expectations without building another elevator, etc. • A shuttle system to the park from Custer, South Dakota. • Implementation of a reservations system. • Opportunity to create a friends group for Jewel Cave or a group that covers Black Hills national parks.

Fundamental Resource or Value	Jewel Cave
Threats and Opportunities	**Opportunities (continued)** • Boundary expansion – need for a land transfer to acquire USFS lands that overlie the cave. • Volunteers could be used more extensively and/or the activities could be promoted more aggressively for some resource management activities as a way to attract future cave stewards. In particular, reach out to additional volunteers for lint camp, which would build expertise and capacity. • Opportunity for the National Park Service to hold easements from private landowners for subsurface rights if lands are added to the boundary. Or the park could work with The Nature Conservancy to hold conservation easements for lands outside the park boundary. This would require funds to monitor in perpetuity. This would grant the legal right to go under privately held land for identification of sensitive areas, stipulations on septic systems. • The lakes are a window into the Madison Aquifer, presenting an ideal opportunity for scientific studies.

Data and/or GIS Needs	• Inventory parts of the cave that have not yet been inventoried.
	• Weather station outside the cave to inform microclimate, precipitation for hydrological studies, climate change studies.
	• Determining the extent, location, and configuration of the cave.
	• LiDAR coverage of the park and surrounding areas would inform as to extent of cave based on geology; would cut fieldwork time. This is becoming the standard.
	• Need to consolidate data of different types into one interface.
	• Photomonitoring of off-trail impacts.
	• Special studies to examine pollution dose-response relationships in sensitive park ecosystems, including the potential impact of mercury and other toxics on biota in the park, specifically in bat hair and blood.
	• Visitor capacity study for the cave.
	• Hydrology study of the lakes.
	• Data collection strategy.
	• Bat research:
	  • Establish baseline microclimate data for the bat hibernaculum.
	  • Establish baseline video documentation of normal wintering behavior.
	  • Conduct an inventory to identify the bat species currently using Jewel Cave.
	  • Conduct ultrasonic acoustic monitoring to identify bat species, and the frequency of their use of surface resources.

Planning Needs	• Boundary adjustment study – Expanding the boundary to over 9,000 acres would ensure that the known cave is included in the monument boundaries. This would be followed by a general management plan amendment to cover new areas in the study. • Resource Stewardship Strategy • Comprehensive condition assessment of the visitor center



Fundamental Resource or Value	Opportunity for Exploration and Discovery in The Cave
Related Significance Statements	All.
Current Conditions and Trends	**Conditions** • Discovery is limited by human condition and natural conditions in the cave to four days. • The farther out you go, exploration becomes more difficult, but there is probably 20 years of exploration easily done with current technology and ability. • Risks are well identified and mitigated. • Cave passages are surveyed as they are discovered. Permanent ink markers are used to identify survey stations and station labels. • Trip leaders are trained by the resource management staff and have access to the cave via a reviewed/approved permit. • Anyone can choose to go on a cave tour and/or volunteer expedition. Those who do not desire to tour the cave in person may view the cave through exhibits and displays and the park film. • Wild Caving Tour allows visitors to enjoy an actual caving experience. • Visitors can participate in a work trip in the cave. • There are eight routes for recreational caving trips. • Some of the cave lies under private land. • Lakes are accessible by cavers. **Trends** • Known cave length is getting longer—on average, 5 miles a year are discovered.
Threats and Opportunities	**Threats** • Risk of serious injury in the cave; rescuing injured or ill persons from deep within the cave is extremely difficult. • Private land is an area with greater risk because of potential impacts from the surface—septic seep and increased runoff from surface development. **Opportunities** • Develop a junior spelunking program. • Obtain easements that would allow legal access to portion of cave underlying private lands. • Develop a Citizen Science Program. • Work with Black Hills State University's interpretive and outdoor education programs to encourage cave stewardship activities, building capacity for volunteers. • Install a WiFi network in the cave along the Scenic Tour route for distance learning presentations online. • Infrared bat cam—installation of hardware is in progress; making microclimate data and infrared bat cam data available for community scientists, school programs. • Promoting ecotourism in the Black Hills (could work with the Custer Chamber of Commerce) promoting volunteer efforts. • Accessibility—transferring video taken in the cave to people outside the cave. Might also reduce the number of walk-outs. • Make an agreement with well-driller to drill a rescue shaft in the event of an emergency. • Social media outreach. • The new Jewel Cave National Monument interpretive film will offer unparalleled remote access to cave features far beyond the tour route. The film will stress exploration and discovery. • Could be used as a water supply to aid ongoing cave exploration.

Fundamental Resource or Value	Opportunity for Exploration and Discovery in The Cave
Existing Data and Plans Related to the FRV	• Cave rescue pre-plan for many of the main travel routes specifying equipment, enlargement of constrictions, required personnel, and time estimates. • Visitor card surveys obtain significant feedback—95%–99% visitor understanding/ satisfaction.
Data and/or GIS Needs	• Visitor surveys. • Visitor capacity study for cave. • Oral histories of Jan and Herb Conn (early climbers and cave explorers), and others. • Hydrology study of the lakes. • Data collection strategy.
Planning Needs	• Develop additional cave rescue pre-plans.

Fundamental Resource or Value	Opportunities for Scientific Research
Related Significance Statements	All.
Current Conditions and Trends	**Conditions** • The bat population has been monitored annually for over 20 years, and appears to be stable and healthy. • Little is known about specific effects of climate change in the local area. • Most existing geological studies are inconsistent and outdated, and do not support recent observations. • Only one paleontological fill is known to exist in the park, just inside the gated Historic Entrance. • Recently discovered subterranean lakes are likely to be pristine and unaffected by human activities. **Trends** • Preliminary "cave potential" studies have begun to define the extent and distribution of undiscovered passages. • There have not been any significant bat studies in nearly 25 years. • Weather patterns appear to be more unpredictable and extreme over the last 30 years. • Recent in-house studies have begun to define a coherent view of geological observations. No work has been done on the paleontological site since a preliminary excavation. • Over 50% of known cave is outside the park. Barometric airflow studies indicate thousands of miles of passages remain undiscovered.
Threats and Opportunities	**Threats** • The northern long-eared bat has recently been listed as a threatened species. • White-nose syndrome is progressing west across the country, and could eventually reach the Black Hills area. • Climate change could impact the viability of the cave hibernaculum. • Inconsistent and outdated geological information (including speleogenesis) is not suitable for presentation in interpretive programs, or for addressing cave-related resource management issues. • Most of the cave passages (known and unknown) are outside the park boundary and are vulnerable to external impacts, primarily from incompatible land use above the passages. • Conducted carefully, research on subterranean lakes would pose no threat to the lakes. **Opportunities** • Conduct new research to study bat populations and their behavioral dynamics (mist netting, radio tracking, etc.). Conduct research of the cave environment to improve understanding of the white-nose syndrome epidemic. • A project to install infrared cameras and a microclimate monitoring station in the cave (in progress) will provide unprecedented opportunities to passively study bat behavior, relative to microclimate of the cave; as well as the change in the cave microclimate, relative to climate change on the surface. • The internet will be used to provide global real-time access to data and streaming video, to enhance interpretive programs, scientific research, and citizen science opportunities. • A project to acoustically monitor bats and their use of the cave (in progress) will provide a more complete picture of how bats use surface resources. • Install a Passive Integrated Transponder tagging system for tracking individual bats. • Continue surface climate and subsurface microclimate studies. • Conduct an energy balance and a mass balance (of water) at the cave entrance, to determine the overall loss of moisture from the cave, and the overall gain or loss of heat through the cave entrance.

Fundamental Resource or Value	Opportunities for Scientific Research
Threats and Opportunities	**Opportunities (continued)** • In conjunction with data from a local surface weather station, researchers can use data from the in-cave microclimate monitoring station to determine the timing and expected impacts on the cave ecosystem. • Continue to pursue geological knowledge of the cave and the surrounding Black Hills area. • Conduct lab work to determine hydrological characteristics of the basal sandstone. • Develop a 3D model of the "cave envelope." • Develop a digital model to depict groundwater flow and dissolution rates. • Examine mineralogy of quartzite clasts (found on the surface, and in the cave), and determine their point of origin. This will enhance understanding of when the cave formed, and will have implications for the geologic history of the entire Black Hills. • The paleontological site could provide invaluable insight about the geological history of Jewel Cave and the Black Hills, and would provide a new opportunity for interpretation and further research. • Continue to develop and fine-tune cave potential studies, to more accurately predict the extent and configuration of the entire cave system. Estimate volume of cave that is too small for human entry. Much of this will rely on new airflow studies, and new geological and geomorphological information.
Existing Data and Plans Related to the FRV	• Over twenty years of mid-winter bat counts. The most recent bat studies are over 25 years old. • Geological maps of the Jewel Cave quadrangle, and a selected zone between Jewel Cave and Wind Cave. Incomplete inventory of geological features in Jewel Cave. One preliminary report on the paleontological site. • Preliminary airflow and cave potential studies. • Cave and Karst Management Plan.
Data and/or GIS Needs	• New evaluation of bat species that use the cave, and related parameters; new tracking data; new acoustic monitoring data. • Local detailed surface climate data. Detailed microclimate data in the cave. • Surface LiDAR imaging for the park and surrounding 50 square miles. Ground-truthing existing geological map data. Additional geological map data. • Complete georeferenced inventory of geological features in the cave. • Identification and geological dating of bones and organic material excavated from the paleontological site. • Hydrology study of the lakes. • Data collection strategy.
Planning Needs	• Data management plans for infrared bat monitoring, acoustic bat monitoring, and microclimate monitoring. • Additional white-nose syndrome planning, as needed.

Fundamental Resource or Value	Natural Processes
Related Significance Statements	• Jewel Cave represents a pristine and relatively unchanged underground environment featuring subterranean lakes, unusual speleothems, and abundant calcite spar. • Jewel Cave National Monument provides important surface and subsurface habitat for wildlife and nine species of bats, including one of the largest known hibernacula for the Townsend's big-eared bat.
Current Conditions and Trends	**Conditions** • Park management allows most natural processes to take their course. • After the Jasper fire, diverse vegetation communities and habitat have attracted wildlife that was not previously seen in the park before the fire. • Invasive species include Canada thistle and leafy spurge. Excess nitrogen deposition is likely increasing the risk of invasive exotic plant infestations. • Some sections of park fencing do not keep out trespassing livestock. • Sporadic help with mountain pine beetle-infested trees from the NPS Black Hills fire module based at Jewel Cave National Monument. • There is insufficient staff for effective beetle management. • Condition of the newly discovered cave lakes is unknown. **Trends** • Signs are that the peak of the beetle epidemic has passed. • The Black Hills landscape could change drastically in the next 100 years. The ponderosa forest could diminish, but, because of the elevation, geology, and soils, it is unlikely that it would be replaced with hardwood forest. • Regional power plants are believed to contribute to air quality impacts in the park. Significant emissions reductions are scheduled by 2018 for the protection of regional class I areas which will also improve air quality conditions at Jewel Cave National Monument. • Trends for the newly discovered cave lakes are unknown.
Threats and Opportunities	**Threats** • Invasive plants threaten to override the natural processes of native species, which could change groundwater chemistry, which could impact speleothem growth, and impact habitat for surface wildlife. Excess nitrogen and sulfur deposition could also change vegetation composition and impact water quality. • Ground-level ozone is in good condition for vegetation health based on NPS Air Resources Division benchmarks. However, the park contains at least seven ozone-sensitive plant species, including ponderosa pine and aspen, that could be effected should ozone levels increase. • Mountain pine beetle infestations threaten the ponderosa pine, the predominant tree in the southern Black Hills. • Trespass livestock can damage vegetation and contaminate surface water, some of which could seep into the cave. • Bats at Jewel Cave may be susceptible to toxic accumulation given their voracious appetite for insects, and their position high on the food chain. • Air quality and views are affected by regional and local sources of air pollution such as power plants, industrial facilities, agriculture, and urban developments. The park is to the east of the Powder River Basin and to the north of the Denver Basin, areas that have seen extensive oil and gas development. New technologies in the oil and gas industry such as horizontal drilling and hydraulic fracturing have further increased extraction in these basins. Oil and gas development may be contributing to nitrogen deposition and ozone levels in the park. If development trends continue, impacts from oil and gas could be a concern in the future. • An increase in mean annual temperature (+4° to +5° F by 2050) with a slight increase in mean annual precipitation (+7% by 2050) projected for the region, along with increases projected for storm frequency/intensity and droughts due to climate change, will impact natural processes. Fire frequencies in the region could increase up to 25% by 2100. Grassland and forest ecosystems are vulnerable to future range shifts due to projected climate change.

Fundamental Resource or Value	Natural Processes
Threats and Opportunities	**Threats (continued)** • Commercial traffic on the highway—a truck accident could cause a spill that would sink into the cave. This has been mitigated by softer curves on the road and detention ponds with filtration. • Threats to the newly discovered cave lakes are unknown. **Opportunities** • There is potential for agencies to work together to mitigate the effects of mountain pine beetle infestations. • Expanded and enhanced interpretation of surface resources through additional wayside exhibits and trail guides could increase visitor understanding, appreciation, and stewardship of surface natural resources. • Expand interpretive and educational tools to communicate the connections between natural processes, Jewel Cave, water quality, bats, climate change, air quality/pollution, night sky, sensitive park resources, human health, and other associated resources. • Continue improving park sustainability and environmental leadership by implementing the park's Climate Friendly Park Action Plan including an Environmental Management System (Director's Order 13A). • Engage with federal, state, tribal, local agencies, industry, and public interest groups, to develop strategies to reduce regional air pollution. • Scientific study of the newly discovered cave lakes can establish baseline data and trends.
Existing Data and Plans Related to the FRV	• Natural resource condition assessment. • Aerial photography. • Satellite remote sensing. • Regional air quality monitoring including visibility, ozone, and deposition.
Data and/or GIS Needs	• Map plots of invasive plants to evaluate impacts of eradication efforts. • Survey the park each year for pine beetle-infested trees. • Terrestrial LiDAR scanning for surface maps that benefit natural process activities and the public. • Special studies to examine pollution dose-response relationships in sensitive park ecosystems, including the potential impact of mercury and other toxics on biota in the park, specifically in bat hair and blood. • Hydrology study of the lakes.
Planning Needs	• Boundary adjustment study.


Photo credit: Art Palmer


Photo credit: Art Palmer

Identification of Key Issues and Associated Planning and Data Needs

This section considers key issues to be addressed in planning and management and therefore takes a broader view over the primary focus of part 1. A key issue focuses on a question that is important for a park. Key issues often raise questions regarding park purpose and significance, and fundamental and other important resources and values. For example, a key issue may pertain to the potential for a fundamental resource or value in a park to be detrimentally affected by discretionary management decisions. A key issue may also address crucial questions that are not directly related to purpose and significance, but which still affect them indirectly. Usually, a key issue is one that a future planning effort or data collection needs to address and requires a decision by NPS managers.

The following are key issues for Jewel Cave National Monument:

- Infiltration of water and contaminants into cave from lands above the cave is a concern.
- Protection of the subterranean lakes from contamination or drawdown from human activities in the surrounding area.
- Over 50% of known cave passages extend beyond the NPS surface boundaries; boundary expansion is needed to protect the cave. A boundary adjustment study is needed to determine the proposed new boundary.
- Need to determine the extent, location, and configuration of the cave to inform the need for additional boundary expansions to protect the cave. Inventory of known parts of the cave to enter them into GIS would help inform a boundary adjustment study.
- Private lands outside boundary—third-party assistance is needed to protect the cave below those lands (easements, purchase from willing seller, etc.).
- Restoration of core of historic district based on the evaluation in the 2006 Cultural Landscape Report.
- Visitor services need to be improved to enhance visitor experience in the historic area. A visitor use survey would indicate possible ways to provide an enhanced visitor experience.
- Insufficient water for fire suppression in historic area puts cabin at risk.
- Accommodating more visitors who want a cave tour. Determining visitor carrying capacity for the cave is an essential data need for addressing this issue, along with a visitor use survey.
- Upgrading tour structures for visitor safety, resource protection, and reduced maintenance. Engineering studies for the cave tour structures and the elevators will help the park maintain and improve safe access to the cave into the future.
- Twenty-year mineral withdrawals (withdrawn from eligibility for mineral exploration).
- Understaffed in all divisions—unable to maintain core operations. Due to budget cuts across the National Park Service, there has been no increase in the park's base budget since fiscal year 2012. The park will likely have to continue to operate within the current budget. Position management will be a key factor in continuing programming at current levels or being forced to cut staff in certain operations areas to remain within the authorized amount. A core operations report may identify ways to better operate under these circumstances.
- Will need to update control systems for elevators in 10 years. Replacement parts for repairs are becoming harder to find or obsolete.
- The elevator system should eventually be replaced because it is becoming obsolete. An engineering study for the elevator system would make recommendations about repair or replacement of elements or the whole system.
- Replacement of the cave tour structure and lighting system along the scenic tour route is needed. Engineering studies for the cave tour structures and the elevators will help the park do this effectively.

Planning and Data Needs

To maintain connection to the core elements of the foundation document and the importance of these core foundation elements, the planning and data needs listed here are directly related to protecting fundamental resources and values, park significance, and park purpose, as well as addressing key issues. To successfully undertake a planning effort, information from sources such as inventories, studies, research activities, and analyses may be required to provide adequate knowledge of park resources and visitor information. Such information sources have been identified as data needs. Geospatial mapping tasks and products are included in data needs.

Items considered of the utmost importance were identified as high priority, and other items identified, but not rising to the level of high priority, were listed as either medium- or low-priority needs. These priorities inform park management efforts to secure funding and support for planning projects.

Planning Needs – Where A Decision-Making Process Is Needed

Related to an FRV?	Planning Needs	Priority (H, M, L)	Notes
Y	Developing other cave rescue pre-plans	H	Expedites cave rescue, lowers cost of rescue and related resource degradation, and increases safety for extricating incapacitated individual.
Y	Boundary adjustment study	H	Would examine potential adjustments to the boundary to protect fundamental resources or for management. Could mean the expansion of the boundary to over 9,000 acres, and responsibility to manage that if owned. A boundary adjustment study would be included in a general management plan amendment to cover new areas in the study, should they be recommended and zoned. There may be issues if land is added to the boundary that has been hunted for many years. This would be brought out during public scoping.
Y	Resource stewardship strategy	H	Plan for resource management beyond year-to-year, making park operations more efficient.
Y	General management plan	M	Critical issues are boundary and visitor use; each of these could be addressed separately in targeted planning documents or together in a general management plan.

Planning Needs – Where A Decision-Making Process Is Needed			
Related to an FRV?	**Planning Needs**	**Priority (H, M, L)**	**Notes**
N	Long-range interpretive plan (LRIP)	M	Internal LRIP completed in 2011. Much of what was set out has been accomplished. Needs to be updated. LRIPs have a five-year life span.
N	Core operations report	M-L	Agency operations evaluation recommended updating the current, obsolete report.
N	Education plan	L	Would inform staffing, types of programs, and activities, youth engagement, and relevancy.

Data Needs – Where Information Is Needed Before Decisions Can Be Made			
Related to an FRV?	**Data and GIS Needs**	**Priority (H, M, L)**	**Notes**
Y	Hydrology study of the lakes	H	Would establish natural conditions and trends of a vulnerable resource. Needed to determine the precise geographic location and depth of the subterranean lakes, water quality, groundwater chemistry, and microbiology, to establish baseline data and trends. This will facilitate future studies of the aquifer and changes in natural conditions.
Y	Data Collection Strategy	H	Needed to establish procedures and best practices for drawing water from the lakes with contaminating them. Would also include an evaluation of logistics required to move equipment and samples to and from a remote location via a difficult cave route.
Y	Mapping and LiDAR of the Southern Black Hills	H	
N	Engineering study for the cave tour structure	H	Update 2008 study by HDR Engineering to support a redesign, with recommendations to meet current safety standards and include cost estimates. This is a safety issue.

Data Needs – Where Information Is Needed Before Decisions Can Be Made			
Related to an FRV?	**Data and GIS Needs**	**Priority (H, M, L)**	**Notes**
N	Engineering study for the elevator system	H	Need to examine the hoistway, possible regenerative drive system, electronic components. Need a system that would supply uninterrupted power. The study would also make recommendations about repair or replacement of elements or the whole system.
Y	Oral histories	H	Make obtaining oral histories a high priority due to advanced age of the individuals.
Y	Map plots of invasive plants	H	To understand the impacts of eradication efforts and to measure progress.
Y	Annual survey for pine beetle-infested trees	H	To plan treatment and measure progress.
Y	Visitor capacity study for the cave	H	Visitor capacity evaluations have always focused on elevator capacity or parking lot capacity. It should be looked at in terms of visitor experience and impacts on the cave. This is also a safety issue.
Y	Determining the extent, location, and configuration of the cave	H	Understanding how the cave formed helps determine its specific location. The 175 miles of known cave passages account for approximately 3% of the entire cave system; 97% remains undiscovered. Over half of the known cave is outside the current park boundary. The park needs to know its extent in order to protect it.
	Comprehensive condition assessment of the visitor center	H	The visitor center contains irreplaceable collections. An upgraded fire suppression system is needed, given the age of the structure and capacity of the current system. The 50-year life cycle (from 1972) is coming to an end.
Y	LiDAR coverage of the park and surrounding areas	H	To give better idea of where the cave can and cannot go based on geology. LIDAR cuts fieldwork time and is becoming the standard.

Data Needs – Where Information Is Needed Before Decisions Can Be Made			
Related to an FRV?	**Data and GIS Needs**	**Priority (H, M, L)**	**Notes**
Y	Bat research: • Establish base line microclimate data for the bat hibernaculum. • Establish baseline video documentation of normal wintering behavior. • Conduct an inventory to identify the bat species currently using Jewel Cave. • Conduct ultrasonic acoustic monitoring to identify bat species and the frequency of their use of surface resources.	H	Given the potential for white-nose syndrome in the future and the importance of the cave as a hibernaculum, there is a critical need for information on the bat community, especially Townsend's big-eared bat and the northern long-eared bat, recently listed as a threatened species. A bat cam and acoustic monitoring projects are currently in progress.
Y	New evaluation of bat species	H	Would provide new information on bat species that use the cave, plus local detailed surface climate data, and detailed microclimate data in the cave.
N	Administrative history	M-H	An administrative history would assist superintendents and resource managers in making informed decisions.
Y	Visitor surveys	M-H	Would obtain significant feedback—95%–99% visitor understanding/satisfaction. Provide evaluations of visitor experiences—who is using the resources, and what benefit are they gaining? How is interpretation reaching the audiences?
N	Engineering study for water delivery	M	Would include recommendations and cost estimates for a structural fire suppression system.
Y	Weather station outside the cave	M	Inform microclimate, precipitation for hydrological studies, and climate change studies.
N	Need to consolidate data of different types into one interface	M	Decreases efficiency to have data in different formats. Systems are too complex to figure out on their own. This would provide an immense increase in efficiency.

Data Needs – Where Information Is Needed Before Decisions Can Be Made			
Related to an FRV?	**Data and GIS Needs**	**Priority (H, M, L)**	**Notes**
N	Visitor use survey	M	Would focus on evaluations of visitor experiences and answer questions about who is using the resources at the park and what benefit they are gaining, how interpretation is reaching the audiences. Understanding visitor patterns would help with maintenance and staffing coverage on busy days.
Y	Inventory known parts of the cave	M	Inventory is needed to fill in data gaps and add that information put into GIS. Cannot perform meaningful GIS analyses with large data gaps. Needed to develop methods to predict location of undiscovered passages and to facilitate/pique interest in future scientific research.
N	Ethnographic overview and assessment	M	Need to identify any traditionally associated tribes.
Y	Special studies to examine pollution dose-response relationships in sensitive park ecosystems	M	Would provide information on the potential impact of mercury and other toxics on biota in the park, specifically in bat hair and blood.
Y	Scientific research	M	The following could be researched at Jewel Cave National Monument: speleogenesis, cave geology, Black Hills geology, mineralogy, paleontology, geomorphology, hydrology, cave microclimate, climate change, and barometric airflow.
Y	Terrestrial/Surface LiDAR imaging	M	LiDAR scanning for surface maps that benefit natural process activities and the public; imaging for the park and surrounding 50 square miles to ground-truth existing geological map data, and add new geological map data.
Y	Inventory of geological features in the cave	M	Complete georeferenced inventory of geological features in the cave.
Y	Identification and geological dating of bones and organic material excavated from the paleontological site	L	Identification and geological dating of bones and organic material excavated from the paleontological site.

Part 3: Contributors

Jewel Cave National Monument

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Appendixes

Appendix A: Enabling Legislation for Jewel Cave National Monument

PROCLAMATIONS, 1908.

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA

A PROCLAMATION

WHEREAS, the natural formation, known as the Jewel Cave, which is situated upon the public land, within the Black Hills National Forest, in the State of South Dakota, is of scientific interest, and it appears that the public interests would be promoted by reserving this formation as a National Monument, with as much land as may be necessary for the proper protection thereof;

Now, therefore, I, Theodore Roosevelt, President of the United States of America, by virtue of the power in me vested by section two of the Act of Congress, approved June eighth, nineteen hundred and six, entitled, "An Act For the preservation of American antiquities," do proclaim that there are hereby reserved from settlement, entry, and all forms of appropriation under the public land laws, subject to all prior valid adverse claims, and set apart as a National Monument, all the tracts of land, in the State of South Dakota, shown as the Jewel Cave National Monument on the diagram forming a part hereof.

The reservation made by this proclamation is not intended to prevent the use of the lands for purposes consistent with the withdrawal made by this proclamation, or for forest purposes under the proclamation establishing the Black Hills National Forest, but the two reservations shall both be effective on the land withdrawn, but the National Monument hereby established shall be the dominant reservation.

Warning is hereby given to all unauthorized persons not to appropriate, injure, or destroy any feature of this National Monument or to locate or settle upon any of the lands reserved by this proclamation.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the seal of the United States to be affixed.

Done at the City of Washington this 7th day of February, in the year of our Lord one thousand nine hundred and eight, [SEAL.] and of the Independence of the United States the one hundred and thirty-second.

THEODORE ROOSEVELT

By the President:
ELIHU ROOT
Secretary of State.

Appendix B: Related Federal Legislation, Regulations, and Executive Orders

Management decisions at Jewel Cave National Monument are based on specific laws, policies, and regulations designed to protect environmental quality, preserve historic resources, promote public enjoyment of the site, and ensure that the benefits and costs of federal action are equitably shared by all citizens. The primary laws of particular importance to the decision-making process and management in the National Park Service are outlined below.

- **The Organic Act of 1916 (16 USC 1 et seq.).** The National Park Service Organic Act remains after nearly 100 years the core of National Park Service authority and the definitive statement of the purposes of the parks and of the National Park Service's mission: "to promote and regulate the use of the federal areas known as national parks, monuments, and reservations. . . by such means and measures as conform to the[ir] fundamental purpose. . . to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations."

- **General Authorities Act of 1970 (16 USC 1).** This Act affirms that all national park areas are "united through their interrelated purposes and resources into one national park system, as cumulative expressions of a single national heritage."

- **Endangered Species Act of 1973 (7 USC 136, 16 USC 1531 et seq.).** The purpose of the Endangered Species Act is to protect and recover imperiled species and the ecosystems upon which they depend. Under this Act, species may be listed as either endangered or threatened. "Endangered" means a species is in danger of extinction throughout all or a significant portion of its range. "Threatened" means a species is likely to become endangered within the foreseeable future. All species of plants and animals, except pest insects, are eligible for listing as endangered or threatened.

- **The Redwood Act of 1978 (16 USC 1a-1).** Congress supplemented and clarified the provisions of the Organic Act through enactment of the General Authorities Act in 1970, and again through enactment of a 1978 amendment to that law (the "Redwood Amendment") contained in a bill expanding Redwood National Park. This Act states that the provisions of the Organic Act apply to all units of the national park system. A key phrase is that activities "shall not be exercised in derogation of the values and purposes for which these areas have been established." It is applicable unless Congress has "directly and specifically provided" otherwise. This Act also affirms that, if a conflict occurs between visitor use and protection of resources, the intent of Congress is to favor resource protection.

- **National Environmental Policy Act of 1969 (42 USC 4321–4370 [42 USC 4321–4370]).** This landmark environmental protection legislation requires federal agencies to integrate environmental values into their decision-making processes by considering the environmental impacts of their proposed actions and reasonable alternative to those actions. The National Environmental Policy Act establishes the format and process that the National Park Service must use in preparing the environmental analyses that are incorporated into the general management planning process. The results of these analyses are presented to the public, federal agencies, and public officials in document format for consideration prior to taking official action or making official decisions.

- **Council on Environmental Quality Regulations, as amended (40 CFR 1500-1508).** These regulations implement the National Environmental Policy Act and provide guidance to federal agencies in the preparation of environmental documents identified under the Act.

- **National Historic Preservation Act of 1966, as amended (Sec. 106 and Sec. 110, 54 USC 300101; 36 CFR 800).** The purpose of this Act is to protect and preserve historic properties which includes any prehistoric or historic district, site, building, structure, or object included on, or eligible for inclusion on, the National Register of Historic Places, including artifacts, records, and material remains relating to the district, site, building, structure, or object. Section 110 requires that the National Park Service identify and nominate all eligible resources under its jurisdiction to the National Register of Historic Places. Section 106 of the Act requires that federal agencies with direct or indirect jurisdiction take into account the effect of any actions on cultural resources listed in or eligible for inclusion in the National Register of Historic Places.

- **Clean Air Act [as amended through Public Law 108–201, February 24, 2004].** In this Act, Congress set a national goal "to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic or historic value" (42 U.S.C. §7470(2)). This goal applies to all units of the National Park System. While the most stringent protections are provided to Class I areas, the legislation also aims to limit the level of additional pollution allowed in Class II areas, and potential impacts on these areas are to be considered.

- **Executive Order 11593, "Protection and Enhancement of the Cultural Environment," May 13, 1971.** This Executive Order directs federal agencies to inventory cultural properties under their jurisdiction, to nominate to the national register all federally owned properties that meet the criteria, to use due caution until the inventory and nomination processes are completed, and also to assure that federal plans and programs contribute to preservation and enhancement of non-federal properties.

- **Archeological and Historic Preservation Act of 1974, as amended (16 USC 469–469c).** This Act requires survey, recovery, and preservation of significant scientific, prehistorical, historical, archeological or paleontological data when such data may be destroyed due to a federal project. The Act directs federal agencies to notify the Secretary of the Interior whenever they find that such a project may cause loss or damage.

- **Archaeological Resources Protection Act of 1979 (16 USC 470aa (1988)).** This Act defines archeological resources as any material remains of past human life or activities that are of archeological interest and at least 100 years old; requires federal permits for their excavation or removal, and sets penalties for violators; provides for preservation and custody of excavated materials, records, and data; provides for confidentiality of archeological site locations; and encourages cooperation with other parties to improve protection of archeological resources. The Act was amended in 1988 to require development of plans for surveying public lands for archeological resources, and systems for reporting incidents of suspected violations.

- **Executive Order 13007, "Indian Sacred Sites," May 24, 1996.** This executive order instructs each executive branch agency with statutory or administrative responsibility for the management of federal lands to (1) accommodate to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions, access to and ceremonial use of Indian sacred sites by Indian religious practitioners; (2) avoid adversely affecting the physical integrity of such sacred sites; and (3) where appropriate, maintain the confidentiality of such sites.

- ***Code of Federal Regulations*, Title 36.** 36 CFR 1 provides the regulations "for the proper use, management, government, and protection of persons, property, and natural and cultural resources within areas under the jurisdiction of the NPS." These regulations are used to fulfill the statutory purposes of national park system units – to conserve scenery, natural and historical objects, and wildlife, and to provide for the enjoyment of those resources in such a manner as to leave them unimpaired for future generations.

- **NPS *Management Policies 2006*.** NPS *Management Policies 2006* is the basic service-wide policy document of the National Park Service. It is the highest of three levels of guidance documents in the NPS directives system. The directives system is designed to provide NPS management and staff with clear and continuously updated information on NPS policy and required and/or recommended actions, as well as any other information that would aid in the effective management of parks and programs.
- **Federal Cave Resources Protection Act of 1988.** The Federal Cave Resources Protection Act (FCRPA) states that: (1) significant caves on federal lands are an invaluable and irreplaceable part of the nation's natural heritage; and (2) in some instances, these significant caves are threatened due to improper use, increased recreational demand, urban spread, and a lack of specific statutory protection. The purposes of the FCRPA are to: (1) secure, protect and preserve significant caves on federal lands for the perpetual use, enjoyment, and benefit of all people; and (2) foster increased cooperation and exchange of information between governmental authorities and those who use caves on federal lands for scientific, educational, or recreational purposes. The FCRPA establishes that "It is the policy of the U.S. that Federal lands be managed in a manner which protects and maintains, to the extent practical, significant caves." In order to comply with the intent of the FCRPA, cave resources must be inventoried, or existing inventories used, to determine the significance of individual caves.

The FCRPA also contains a Freedom of Information Act (FOIA) exemption, addressing the confidentiality of information concerning the specific location of significant caves to ensure protection of the resource. The FCRPA states: "Information concerning the specific location of any significant cave may not be made available to the public under Section 552 of Title 5, *United States Code* (USC) [FOIA] unless the Secretary determines that disclosure of such information would further the purposes of this chapter and would not create a substantive risk of harm, theft, or destruction of such cave" (16 USC 4304(a)).

Other Relevant Laws, Executive Orders, and Regulations

- The Antiquities Act of 1906
- Historic Sites, Buildings, and Antiquities Act of 1935
- Museum Act (16 USC 18f through 18f-3)
- "Protection of Historic Properties" (36 CFR 800)
- Americans with Disabilities Act of 1990
- Architectural Barriers Act of 1968
- Architectural Barriers Act Accessibility Standards 2006

NPS Policy-level Guidance

- Director's Order 28: *Cultural Resource Management* (1998)
- Director's Order 28A: *Archeology* (2004)
- *The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation*
- Director's Order 24: *Museum Collections Management*
- NPS *Museum Handbook, Parts I, II, and III*
- Director's Order 11D: *Records and Electronic Information Management*

Appendix C: Glossary

Cave Features

Boxwork	Boxwork formed when thin veins of calcite were deposited in cracks in the rock; the rock was preferentially removed at a later time, so that the veins now stick out in relief. When the veins cross each other at right angles, they often resemble post office boxes. Because it was formed by the removal of bedrock, boxwork is considered a speleogen, rather than a speleothem.
Calcite crystals	After the cave formed, while the passages were still completely submerged, calcite-rich water deposited a layer of calcite crystals on any available cave surface, before draining away. In a few places, the calcite coating is over a foot thick. Crystals with a blunt three-sided point are called nailhead spar, and those with sharp six-side points are called dogtooth spar.
Calcite rafts	Sometimes calcite forms on the surface of a pool of water. Surface tension actually allows it to float until it gets too heavy, and pieces break off and sink to the bottom of the pool. Most calcite rafts are white and paper thin.
Cave popcorn	Cave popcorn consists of white knobs of calcite formed through an evaporation process. It has a strong resemblance to popcorn.
Dripstone	After the cave drained, dripstone formed when water dripped from—or seeped across—cave surfaces, depositing calcite as it went. Dripping water can form stalactites (which hang from the ceiling) and stalagmites (which come up from the floor). Flowstone occurs where seeping water deposits smooth layers on walls and floor surfaces. Draperies form when water trickles down a sloping surface, leaving behind a ridge of calcite.
Frostwork	Frostwork was formed by evaporation of calcium-rich moisture. It looks like actual frost but consists of a form of calcium carbonate called aragonite.
Gypsum formations	Many gypsum formations were formed when crystals were extruded from sediment or a rock surface. They apparently formed as part of an evaporative process at a time when the cave was drying out. Gypsum flowers are white or translucent shapes that resemble toothpaste squeezed from a tube. Gypsum needles have a thin needle-like shape. Gypsum beards consist of many strands of gypsum, clumped together like a beard.
Helictites	Helictites are fingers of calcite deposited by seeping water that defy gravity by growing in any direction.
Hydromagnesite balloons	Hydromagnesite balloons were first discovered in Jewel Cave, and have since been found in half a dozen other caves throughout the world. These delicate bubbles of hydromagnesite typically have a pearly white luster and come in a variety of irregular shapes. They are no more than 2 inches across, and the shell is less than a thousandth of an inch thick. The balloons appear to have been inflated, but the details of their origin are currently unknown.
Manganese	The term "manganese" is short for manganese oxides and hydroxides. The actual mineral structure is unknown. These brown to black, powdery deposits were chemically precipitated from the water that once filled the cave. Manganese will permanently stain clothing and is very slippery—especially when wet.
Popcorn stalagmites	Popcorn stalagmites are shaped like stalagmites with a popcorn texture. However, they probably were not formed by the same process as cave popcorn. Some have holes down their central axis, and occasionally the hole is even deeper than the stalagmite is high. The nature of their origin remains a mystery.
Speleogen	A geological formation in a cave that has been created by the removal of bedrock, rather than as a secondary deposit.
Speleothem	A secondary mineral deposit formed in a cave.

General Terms

CCC	Civil Conservation Corps – A public work relief program that operated from 1933 to 1942 in the United States for unemployed, unmarried men from relief families as part of the New Deal.
CLR	Cultural landscape report – A primary document for guiding the management and preservation of cultural landscapes.
Hibernaculum	A winter roost for hibernation.
HRS	Historic resources study – A document that identifies and evaluates the historic events and resources related to a particular area.
I&M	Inventory and monitoring – A formal procedure for identifying natural resources, and measuring and documenting changes that take place over time.
Karst	A landscape formed from the dissolution of soluble rocks including limestone, dolomite, and gypsum. It is characterized by sinkholes, caves, and underground drainage systems.
LiDAR	A remote sensing technology that measures distance by illuminating a target with a laser and analyzing the reflected light.
Lint tarps	Nylon tarps that are fastened beneath the stairs, bridges, and platforms of the scenic cave tour route to capture lint that falls from visitors' clothing. Each year, the park removes, cleans, and reinstalls the tarps to keep the lint from collecting on cave surfaces.
LRIP	Long-range interpretive plan – A document that provides a vision for the future (5–10 years) of interpretation, education, and visitor experience opportunities.
Mineral withdrawal	A mineral withdrawal removes the land from "mineral entry." It essentially closes an area of federal public lands to mineral extraction, subject to valid existing rights.
NRHP	National Register of Historic Places – The US federal government's official list of districts, sites, buildings, structures, and objects deemed worthy of preservation.
Radon	Radon is a radioactive, colorless, odorless, tasteless gas, occurring naturally as an indirect product of decaying uranium or thorium. As radon itself decays, it produces new radioactive elements called radon daughters. Unlike the gaseous radon, radon daughters are solids and stick to surfaces such as dust particles in the air. If such contaminated dust is inhaled, these particles can stick to the airways of the lungs and increase the risk of developing lung cancer.
USFS	United States Forest Service – An agency of the US Department of Agriculture that administers the nation's 154 national forests and 20 national grasslands.
White-nose syndrome	A fungal disease that is killing millions of bats in North America. The fungus invades the skin of hibernating bats and disrupts both their hydration and hibernation cycles, which can lead to death.

Photo credit: Art Palmer

Midwest Region Foundation Document Recommendation
Jewel Cave National Monument

February 2016

This Foundation Document has been prepared as a collaborative effort between park and regional staff and is recommended for approval by the Midwest Regional Director.

B A Schwartz 2-8-2016

RECOMMENDED
Bonnie Schwartz, Superintendent, Jewel Cave National Monument **Date**

C H Sholly 2/4/2016

APPROVED
Cameron H. Sholly, Regional Director, Midwest Region **Date**

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historic places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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