

# APACHE-SITGREAVES NATIONAL FOREST

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## RECOMMENDATIONS FOR CAVE AND KARST MANAGEMENT

9/1/2015



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## I. INTRODUCTION

The Recommendations for Apache-Sitgreaves National Forest Cave and Karst Management provides cave and karst management policies and techniques. The goals are threefold;

1. Provide a structure under which Forest personnel can consistently manage the non-renewable resource.
2. Provide a structure under which volunteers and researchers can work with the Forest personnel to better understand the resource.
3. Provide the public a better understanding of techniques used for safer and non-harmful recreational caving.

This document is organized as follows:

1. The **Chapters** are the strategic management requirements based on the laws (authorities) and the Forest Service Manual (FSM) policies implementing the laws. FSM references are provided.
2. The **Appendices** are the tactical techniques for sustainable and conservative cave and karst management. Included are ethics guidelines, Significant Cave nomination, file management, surface management, research guidelines, monitoring techniques, cave management classification, confidentiality, and more.

**Hyperlinks** are in **blue bold** to allow easier access between the policies and the implementation techniques.

## A. AUTHORITIES

These are the principal Federal laws and regulations affecting management of caves on National Forest System Lands.

1. The Organic Administration Act of June 4, 1897. (16 U.S.C. 551). This Act authorizes the Secretary of Agriculture to regulate occupancy and use of the National Forests. Regulations issued under the Act authorize protection of cave resources from theft and destruction (36 CFR 261.9a, 9b, 9g, and 9h). Under 36 CFR 294.1, classification is authorized for special interest areas that are managed for recreation use substantially in their natural condition. Special closures are authorized under 36 CFR 261.53 to protect threatened cave resources.
2. Federal Cave Resources Protection Act (FCRPA) of 1988 (16 U.S.C. 4301-4309; 102 Stat. 4546). The purposes of this Act are to secure, protect, and preserve significant caves on Federal lands for the perpetual use, enjoyment, and benefit of all people. To foster increased cooperation and exchange of information between governmental authorities and those who utilize caves located on Federal land for scientific, education, or recreational purposes. The act sets forth management actions, confidentiality of significant cave locations, describes permitting, prohibited acts, and penalties
3. Code of Federal Regulations (CFR) Title 36: Parks, Forest and Public Property, Part 290 Cave Resources Management. June 17, 1994. These are the implementing regulations applying to cave management on National Forest System lands. The regulations provide definitions; the

process for nomination, evaluation and designation of significant caves sets forth rules regarding confidentiality of cave location information and collection of cave information.

4. Title 36 CFR, Part 291: Paleontological Resources Preservation Act of 2009. These regulations set forth requirements for managing, protecting, and preserving paleontological resources on National Forest System (NFS) land using scientific principles and expertise.
5. Antiquities Act of 1906 (34 Stat. 225; 16 U.S.C. 431 et seq.). This Act provides for the protection of historic or prehistoric remains or any object of antiquity on Federal land. Criminal sanctions are authorized for destruction or appropriation of antiquities. Scientific investigations of antiquities on Federal lands are permissible subject to permit and regulations. Uniform rules and regulations pursuant to this Act are in FSM 1530.12.
6. The National Environmental Policy (NEPA) Act of 1969 itself is only a couple of pages long and simply compels all Federal Agencies to do the following prior to undertaking an activity:
  - A. Consider environmental impacts (environmental analysis) in their decision making,
  - B. Involve the public, and
  - C. Document the process by which the agency made its informed decision.

Federal Agencies are required to evaluate relevant environmental effects of federal actions. This is accomplished by one of three levels of analysis: a Categorical Exclusion (CE), an environmental assessment (EA)/Finding of No Significant Impact (FONSI), and, environmental impact statement (EIS) depending on the complexity and type of action being analyzed.

7. Archaeological Resources Protection Act (ARPA) October 31, 1979 (16 U.S.C. 470aa). This Act clarifies and defines "archaeological resources," prohibits the removal, sale, receipt, and interstate transport of archaeological resources obtained illegally from public lands. The Act authorizes confidentiality of site location information, authorizes permit procedures to enable study and investigation of archeological resources on public lands by qualified individuals; provides for substantial criminal and civil penalties, forfeiture of equipment used in the crime, and rewards for citizens who report the crime. The Act supplements but does not replace the Antiquities Act of 1906.
8. Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531). The Act was established to prevent the extinction of plant and animal life and to recover and maintain their populations by removing or lessening threats to their existence. The Act describes the process for determining endangered and threatened species, establishes prohibited acts, prescribes penalties, mandates a recovery plan, and defines interagency and State cooperative relationship requirements.
9. Freedom of Information Act of 1967 (5 U.S.C. 552(b)(3)) allows the public to seek disclosure of Federal agency information, but also requires agencies to protect some classes of material from disclosure including documents that are not formal products of the agency or official correspondence.

## **B. FOREST SERVICE MANUAL AND HANDBOOK DIRECTION**

Forest Cave Management Manuals and Handbooks provide a comprehensive strategy for managing caves while allowing for compatible recreational and other uses which will not cause irreversible damage to outstanding cave resources or harm to cave-reliant organisms. Emphasis is placed on

allowing natural processes to proceed unimpeded. This handbook establishes a strategic approach and set of generalized guidelines to assist Forest resource managers in the administration and protection of cave resources.

**FSM 2800 Minerals and Geology Manual**

Chapter 2880 Geologic Resources, Hazards and Services –discusses management of cave and karst resources and their ecosystems.

**FSM 2300 Recreation, Wilderness and related Resource Management**

Chapter 2356 Cave Management. Policy and direction relating to cave management.

**FSH 2809.15 Minerals and Geology Handbook**

Chapter 25 Cave Safety Standards. Establishes a course of action that can be followed to assure minimal risk to people entering caves on public lands.

**C. EXTENT OF CAVE & KARST RESOURCES – Apache-Sitgreaves National Forest**

The Forest contains many different types of caves, karst, and cave features: shelter caves, earth cracks (fissure caves), maze caves, stream caves, sinkholes, and pits. Most of the caves are only well known by local cavers. At least four of the five Districts have caves. At least three Districts contain a large, active, karst blocks.

The two primary types of caves are found on the Forest are lava tube caves and caves found in the Kaibab Limestone. In the Clifton District there limestone pockets containing caves. The majority of the caves are in the Kaibab Limestone. There are also large areas of both karst and pseudo karst that have not yet been checked for caves. Additionally there caves in the limestone lenses interspersed between sandstone bedding planes in other areas. There are some caves and shelters in sandstone.

The forest has documentation on caves that have been nominated as significant caves (Forest Service, 2011). One of the significant caves is Harris Cave which is a recreational cave that is open to the public. The significant caves variously meet the criteria for significance on the basis of their geologic/mineralogic/paleontologic values, biota, cultural values, hydrologic values, recreational, educational or scientific values. Several other caves are known in the files and some have a resource evaluation report written for them. However, nomination forms are missing or absent and documentation that a significant cave decision is lacking for these caves. To date, the Forest has information on several caves and karst features across the forest.

**D. CAVE AND KARST MANAGEMENT**

**CAVE MANAGEMENT OBJECTIVES**

- Protect and maintain significant cave resources in accordance with the policies outlined in the Forest Service Directive System and management direction contained in the Forest Plan (CFR 36 Part 290 FS implementation).
- Provide cave related recreational, cultural, educational, and scientific study opportunities that serve public needs (FSM 2372).

- Balance surface resource management and cave use with the protection of significant cave values (FSM 2372).
- Interpret surface and subsurface geologic conditions and processes (such as caves and karst) as they relate to or affect the capability of National Forest System lands to produce renewable and non-renewable resources (FSM 2880).

### **CAVE MANAGEMENT POLICY**

Preserve and protect non-renewable cave and karst resources so their scientific and aesthetic value does not diminish<sup>1</sup>.

1. Manage significant caves as a nonrenewable resource to maintain their geological, mineralogical, scenic, educational, scientific, cultural, biological, hydrological, paleontological, and recreational values (FSM 2372).
2. Protect and preserve significant caves by regulating or restricting use, as appropriate, and monitoring the condition of cave resources. (FSM2882.6)
3. Identify the geologic components of ecosystems (including geologic processes, materials, landforms, fossils, caves and significant outcrops) and monitor and manage them in a manner appropriate to meet Forest Service responsibilities for National Forest System (NFS) lands and resources (FSM 2880.3).
4. Classify caves containing outstanding values as Geological or Historical Areas (FSM 2372).
5. Emphasize wild cave management with few or no facilities to aid or facilitate use (FSM 2372).
6. Develop management prescriptions for significant caves (FSM2372).
7. Determine the actions necessary for protection, mitigation and recovery of cave resources and ecosystems. (FSM2882.6)
8. Coordinate surface and cave resource management activities (FSM2372). Determine the effects of all proposed activities on the hydrologic function and biological significance, safety, recreational opportunities and cultural and paleontological resources of cave resources and ecosystems. (FSM2882.6)
9. Protect threatened, endangered, proposed and sensitive, species in accordance with the Endangered Species Act (16 U.S.C. 1531) and FSM 2670. (FSM2372)
10. Determine the need for protection of cave resources and ecosystems as critical wildlife or aquatic habitat. (FSM2882.6)
11. Protect cultural sites and deposits in accordance with FSM 2361.03.(FSM2372)
12. Develop and foster communications, cooperation, and volunteerism with interested publics, Federal agencies, States, and local governments. (FSM2372)
13. Promote volunteer management agreements and the exchange of information with the scientific and recreational caving communities. (FSM2882.6)
14. Secure all cave-related documents to protect cave locations. (FSM2882.6)

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<sup>1</sup> [http://www.fs.fed.us/cdt/main/fsm\\_2350\\_2300\\_2009\\_2.pdf](http://www.fs.fed.us/cdt/main/fsm_2350_2300_2009_2.pdf)

## **KARST MANAGEMENT OBJECTIVES**

Determine and manage significant karst features with respect to dimensional characteristics, level of connectivity between the surface and subsurface, hydrological characteristics, geological, biological, scientific, archeological, historical, cultural and educational values, recreational and commercial values, variety and abundance, and visual quality.<sup>2</sup> More extensive karst management objectives and procedures are in [Appendix J – Karst Management](#).

1. Implement the different levels of karst inventories to determine their relation to karst management (Order 4 to Order 1).
2. Identify the desired conditions and recommended management practices for sinking and losing streams/sinking watercourses.
3. Reduce soil erosion around and into karst features.
4. Reduce sedimentation into karst features.
5. Understand how to apply the recommended management practices based on the assessed vulnerability of the karst.
6. Apply best management practices to road building.
7. Apply best management practices to timber harvesting.
8. Apply best management practices to post-harvest operations.
9. Apply best management practices for thinning, fire reduction, and forest health.
10. Consider wildfire and prescribed fire impacts on karst features and caves.
11. Understand the management objectives and recommend management practices for the non-karst portion of karst catchments.
12. Understand the safety issues associated with karst terrain.

## **POLICY**

Implement karst management for significant karst features that buffer and mitigate disturbances to the features. Buffer zones and siltation reduction activities around karst features and will be addressed when planning grazing, timber harvesting, and non-sealed road construction in karst areas.

## **Strategy and Management**

Determine significant karst features and understand its importance.

1. Identify the management objectives and recommended management practices for significant karst features.
2. Implement buffer zones around significant caves and karst features
3. Apply best management practices for thinning, fire reduction, and forest health.

## **E. GENERAL ADMINISTRATION AND MANAGEMENT**

Cave resources are both fragile and non-renewable and special considerations are required to provide resource protection and recreational opportunities.

All known caves will be inventoried and evaluated Forest-wide under provisions of FCRPA to determine resources, condition, and significance. Newly discovered caves will be inventoried and evaluated as they become known.

Management priorities will be assigned based on resource inventory, rating, classification and evaluation of current conditions, and long-term management objectives.

Cave management files will be prepared for all significant caves and other caves deemed appropriate. Cave files will include such information as interim protection measures, monitoring requirements, Limits of Acceptable Change (LAC), funding priorities and management prescriptions. Cave management files may be prepared concurrently with cave inventories, and evaluation. Cave management plans will be prepared when needed.

Closure orders may be maintained at both the Forest and District Offices. The need for further restrictions, (i.e. closure orders, entry permits, gates), will be determined for each cave as its management prescription is developed.

Management conflicts will be resolved based on the relative importance assigned to conflicting resource values. Compromises need to preserve the cave resources and maintain the recreation opportunities. An example of such a compromise would be seasonal closure of an important bat roost, while maintaining the opportunity to explore the cave the rest of the year.

## **F. PUBLIC INVOLVEMENT**

Public involvement and participation will be encouraged to develop and enhance the efficiency and quality of cave management. The Forest will seek participation from interested individuals and organizations, such as caving groups, scientists, recreationists, and develop interests in managing the cave and karst resources.

The Forest, with each District's input will develop and maintain a current mailing list of interested parties regarding cave management. The mailing list will be utilized to announce resource activities planned within each District.

Specific information concerning significant caves on the Forest will not be made available to the public (36 CFR §290.4). This information will be treated as confidential and secured in such a manner as to prevent access by non-authorized individuals. The cave coordinator will maintain the cave files and ensure that access is provided on a need-to-know basis only.

Proposed policies and guidelines will be circulated to interested groups, grottos, and individuals for review. The Forest and Districts will include interested parties on an as needed basis to discuss current activities and plan for future projects. Confidentiality will be used in protecting cave location information as required by FCRPA.

The Forest will utilize volunteers and cost-share agreements to complete projects when applicable. Responsibilities of volunteers will be established prior to the approval of their work agreement.

## II. CAVE EVALUATION AND CLASSIFICATION

Caves will be evaluated for management in one of four Classes.

- Class 1 – Directed Access Caves – caves that do not have unique hazards and information including directions are provided.
- Class 2 – Non-permit Caves – caves that do not have unique hazards to human use and may not generally known to the public
- Class 3 – Permit Caves – caves that have sensitive features or safety hazards
- Class 4 – Preserve Caves – caves that have extremely sensitive or pristine resources.

Further Cave Class descriptions are at [CAVE CLASSIFICATIONS](#).

The evaluation and rating, process allows managers to evaluate the significance of individual caves and to compare the relative values of different caves. This rating process allows identification of caves with high values or sensitivities to disturbance.

Each cave's classification is also affected by the general public's awareness of the cave.

- Category 1 – Generally Known Caves.
- Category 2 – Lesser Known Caves.

These categories are beneficial for determining what information is publicly available. For example, a Class 1 – Directed Access cave may have information and directions available at the District or Supervisor's office

Each cave's evaluation and rating are contributory to determining a cave's significance. The cave management categories are further described in [Appendix C – Cave Management Categories](#).

The evaluation process addresses both areas with the CAVE RATING SUMMARY.

### B. SIGNIFICANT CAVE NOMINATIONS

The Forest Service implementation regulations for FCRPA establishes rules for determination of cave significance (36 CFR §290.3). To be found significant, a cave must possess values in one or more of the following categories: Biota, Cultural, Geologic/Mineralogic/Paleontologic, Hydrologic, Educational, or Scientific. In addition, any cave located within a special management area, designated wholly or in part due to cave resources found therein, shall also be determined significant. This includes such areas as national monuments, special areas, research natural areas, or other areas of special interest. Forest Supervisors are responsible for nominating all known caves for determination of significance. Caves determined to be significant will be governed under provisions of the FCRPA with an objective to secure, protect, and preserve significant caves for the perpetual use, enjoyment, and benefit of all people, and

to foster increased cooperation and exchange of information with those who utilize caves for scientific, educational, or recreational purposes.

Caves not determined significant will be managed under the Standards and Guidelines of the Forest Plan, FSM 2356, FSM 2880 and 36-CFR; §261-Prohibitions.

Significant cave nomination worksheets and additional information can be found in [Appendix E – Significant Cave Designation Process](#).

### C. CAVE INVENTORY PROCEDURES

Promote ongoing relationships with caving organizations.

Cave inventories are helpful for making determinations of cave significance and classification but are not mandatory for nomination to the significant cave list. Cave inventories become increasingly important as management plans are developed for individual caves or caves in the same area.

In addition to the cave’s name, each cave will be assigned a unique cave inventory number that will be entered into the Forest Service INFRA system for management and tracking purposes. Cave numbers will be assigned to each cave entrance. Caves with multiple entrances will bear the same number at each entrance, followed by alpha characters (A, B, C, etc.) to differentiate between individual entrances. Cave numbers are assigned by Region, Forest, and Unit, followed by consecutive numbers for each cave on the Unit (refer to Table 1 for example of this cave number).

**Table 1: Forest Service Cave Numbering System.**

<b>Forest Service Cave Numbering System. (These numbers appear on all cave records.)</b>	
<b>3</b>	Region 3 (Arizona, New Mexico)
<b>##</b>	Region 3 – Forest Numbers:
<b>01</b>	01 Apache Sitgreaves NF      04 Coconino NF      07 Kaibab NF      10 Santa Fe NF 02 Carson NF      05 Coronado NF      08 Lincoln NF      12 Tonto NF 03 Cibola NF      06 Gila NF      09 Prescott NF
<b>##</b>	Forest – Ranger District Numbers:
<b>06</b>	01 Alpine RD      03 Clifton RD      07 Springerville RD 02 Black Mesa RD      06 Lakeside RD
<b>###</b>	Cave No. ### on the Unit
<b>A</b>	First Entrance Identified

A cave on the Santa Catalina Ranger District has a designation of 3 05 05 001 A.

Cave Name	Cave #	Region	State	Forest	District	Criteria * Met	(B)	(C)	(G,M,P)	(H)	(R)	(E,S)
Harris	30106-001A	03	AZ	Apache-Sitgreaves	Lakeside	x			x		x	x
Blue Ridge Ice	30107-002A	03	AZ	Apache-Sitgreaves	Springerville	x			x		x	x

\* Criteria include (B)iological, (C)ultural, (G,M,P) Geologic/Mineralogic/Paleontologic, (H)ydrologic, (R)ecreational, or (E,S) Educational or scientific. [NOTE: Above cave number designations and significance criteria need to be verified with Apache-Sitgreaves District files.](#)

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The process of locating and evaluating caves on the Forest is ongoing. As a new cave are found, or as additional information comes to light and is collected, the inventory list will grow. The Forest will continue to aggressively pursue collection of inventory data using volunteer agreements, cost-share agreements, and Memorandums of Understanding (MOU's) with caving organizations, Forest Service personnel or contract specialists. All persons involved in inventory should be aware of the spectrum and fragility of cave resources on the Forest so that these resources are not inadvertently damaged. Inventory workers will abide by "caving ethics" ([Appendix A - Caving Ethics](#)), and should also be aware of other known caves in the area so that these are not re-inventoried. Inventory work will be coordinated and managed by a Forest Service employee with cave coordination responsibilities. Assistance will come from local cave management partner organizations, volunteers and other stakeholders.

Information concerning the location of caves will be kept confidential, in accordance with provisions of the FCRPA (FCRPA §5, 36 CFR §290.4, FSM 2356.2 [1]). Only the location of caves classified as "Directed Access" will be made available to the public.

Cave locations recorded in Geographic Information System (GIS) will be placed on a separate, secure layer, and all inventory records will be maintained in a locked file. Access to these records will be permitted on a need-to-know basis only. Generalized information which does not lead to the disclosure of cave locations, may be made available if it is determined that such disclosure would not constitute a threat of theft, damage, or harm to cave resources, and is consistent with the purposes of the FCRPA, the implementation regulations, Forest Plan Standards and Guidelines, and FSM 2356.

A file of permanent data will be maintained for each cave. This file will remain locked, with access provided on a need-to-know basis only. At a minimum, the following basic information is needed to populate INFRA and will be collected and maintained for each cave (refer to Table 2). Master and Public file information are in [Appendix H - Individual Cave Management Files](#).

<b>Table 2: Information to be Maintained as Part of Each Cave File.</b>	
Cave Name	Township, Range, Section, Quadrant
Cave Number (entrance number)	USGS Quadrangle Number
Date of Determination of Significance	Cave Classification: Directed Access, Non Permit, Permit, Preserve
Date Marker Cap Set	Special Management Concerns
Cave Length	Descriptive Notes
Latitude of entrance	Cave location marked on Air Photo Overlay
Longitude of entrance	Cave location on a USGS 7 1/2 minute 1:24,000 topographic map
Elevation of entrance	Cave Map (if not mapped, a sketch will be provided)
Name of Person Supplying Data, and Date	Type of Entrance
Pattern of Cave	Azimuth of Entrance
Vertical Relief	Number of Entrances
Number of Levels	Length of Passage
Water Elements	Cave Map (Yes or No)
Hazards	Special Equipment Needed
Special Skills Required	Type of Protection Needed
Cave Contents	Geologic Formation
Rock Type	Type of Cave
Categories of Significance satisfied:	

Geological, biological, scientific, archeological, historical, cultural and educational values	
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## D. EVALUATION AND RATING RESOURCES

Each cave’s classification and overall management is determined by the cave’s resource category and class evaluation. The management categories provide the ability to compare cave resources on a Forest-wide basis, and identify caves requiring priority management.

A relative system for evaluating cave resources on the forest is presented in [Appendix D – Cave Evaluation and Rating Guidelines](#). These rating guidelines are inputs for Significant Cave nominations, located in [Appendix E – Significant Cave Designation Process](#). The Significant Cave Designation Process lists the criteria needed to become a significant cave. The [SIGNIFICANT CAVE NOMINATION WORKSHEET](#) lists the information needed to help with the evaluation. [Appendix F - General Inventory Procedures](#) lists additional areas to be considered when conducting the inventory. Values are rated in three categories; low, moderate, high. A resource is usually assigned the rating which best describes it. However, in some cases one feature may be so different or unique from other features that it alone determines the rating for that resource. Examples could include the longest soda straw in the state or an extensive Pleistocene fossil deposit.

The cave management classification system is used to **establish priorities** in cave management. Each cave is assigned a management priority based on its resource value, sensitivity level (exposure to destructive impacts), and Limits of Acceptable Change (LAC). Cave classification is the beginning of cave management. Using the evaluation/ratings as a guide, the manager makes the decision into which of the classifications to place individual caves. Prioritization focuses where active management and monitoring are needed, and where passive management and monitoring may be applied. There is no hard and fast rule for classification, and classifications are admittedly broad and somewhat generalized. What is important is to determine if special management is needed or if changes in current management are warranted.

Classification of caves is not a substitute for cave management but rather a means of sorting and categorizing individual caves. It is still necessary for the District Ranger to make prudent decisions concerning the cave resources they manage.

### **III. CAVE MANAGEMENT**

#### **A. CAVE MANAGEMENT TECHNIQUES**

In order to protect valuable cave resources, a variety of management techniques can be used. These may be used in different combinations or individual techniques may be altered to produce a more desirable management. A description of common management techniques is presented in [Appendix G – Cave Management and Monitoring](#).

The decision to gate a cave is warranted for various reasons (safety, public encroachment, resource sensitivity, species protection, etcetera) and should not be taken lightly. If it is determined that a cave gate is needed, it changes the cave’s management level. Cave gate related items are included in [Cave Gates](#) and [Caves](#). Interim closure orders, the cave’s management prescription including access levels is needed. Usually safety and biological comments are helpful in developing a safe gate design that will not deny habitat. Additional considerations are listed in section [L. ADAPTIVE MANAGEMENT](#), and section [H. LIMITS OF ACCEPTABLE CHANGE \(LAC\)](#).

#### **B. SURFACE LAND MANAGEMENT - KARST**

Surface land management decisions need to include consideration of potential impacts to all caves and karst. Maintenance of cave microclimate, hydrology, and entrance vegetation is needed in order to protect long-term cave ecology and microclimate. Most cave entrances are karst features. Surface land management guidelines for caves are in [Appendix J – Karst Management](#)

All management activities planned near or within a known cave and karst area need to be examined for potential impacts to caves and karst features. Activities which increase sedimentation, sterilize soil, change a cave's natural hydrology or water quality, add nutrients, pesticides, herbicides, or fertilizers, or modify the cave, cave entrance, or passages will not be permitted without evaluation and approval through the National Environmental Policy Act (NEPA) process.

A suitable area of at least a 300 feet radius around cave entrances, infeeder drainages, and surface areas immediately over cave passages needs to be evaluated for effects on cave resources and ecology. These areas will include all necessary mitigated measures necessary to protect cave features. Unauthorized major alterations to caves are not permitted. Cave entrances and karst features will not be used as disposal sites for slash, waste rock, fill materials, storm water runoff or other refuse.

#### **C. CAVING ETHICS**

Educating the public on the importance of preserving cave resources is an integral part of cave management. Guidelines outlined in [Appendix A - Caving Ethics](#) will assist Forest Service personnel in educating the public, and will allow the public the opportunity to familiarize themselves with proper caving etiquette.

#### **D. CAVE RESEARCH GUIDELINES**

The USFS recognizes the value of having scientific research conducted within caves and in areas containing karst landforms on public forest lands. Information gained through research not only contributes to the general knowledge of caves, but ensures that responsible management of these non-

renewable natural resources is informed, appropriate, balanced, and science based. Scientific research conducted in caves is thus in the public interest both for the advancement of science and as a conservation management tool.

Caves are not isolated features, but are elements that are integrated into the landscape. Thus, management of lands that overlie caves, which occur within the watershed in which caves are present, or that have hydrologic or other physical connectivity with caves is integral to the maintenance and conservation of caves and their contained resources.

Caves may contain important biological, archaeological, paleontological, hydrological, geological and esthetic resources. Some of these resources commonly co-occur in individual caves. All of these resources are potentially fragile and are susceptible to damage through uninformed, careless or unmanaged human activities. Some caves or portions of caves with exceptionally sensitive resources may be managed exclusively for research, with access limited to permitted research personnel.

Research activities may require sampling of representative materials and/or disturbance of life forms occupying caves. Responsible sampling of one resource, even using the best techniques, has the potential to impact other resources. Archeological and paleontological resources are particularly subject to physical damage or disruption of their contextual character, severely reducing their value for future research. Uninformed or inconsiderate recreational cavers or researchers can damage or destroy invaluable and irreplaceable scientific resources by simply traveling through a sensitive area. Projects for different scientific fields of study should be given equal consideration and weight, and no single field of study should have exclusive priority in cave management and access.

It is the responsibility of the USFS as the steward of these public resources to use the current best management practices in overseeing any research activities in caves on the Forest. Cave research activities must minimize impacts to targeted resources, and collateral damage to non-target resources. The potential value of knowledge to be gained from a given research effort will be reviewed by the Forest Service and balanced against known or potential impacts to cave resources that may result from the proposed research activity. A determination will be made by the Forest Service on the efficacy of the proposed research prior to granting permission and the issuance of appropriate permits to the research proponent.

Perishable organic materials, including most paleontological and some archeological resources may be susceptible to degradation over time due to in-situ cave environmental conditions. These resources need to be evaluated by knowledgeable personnel to determine whether materials will be best conserved by preservation in place, or removal and placement in a climate-conditioned public repository.

Effective and responsible management of any natural resource is dependent on detailed knowledge of the resource. Crucial to the management of cave and karst resources on the Forest is knowledge of the presence of caves (where they occur), a detailed understanding of the physical limits of caves (accomplished by survey and mapping of caves), and their hydrologic connectivity with regional water resources. Caves that do not have an evident surface expression or humanly accessible entrance are likely to be present on the Forest. Unknown cave resources could be permanently adversely affected by

alteration of surface or subsurface features resulting from logging, mining, or other ground disturbing development activities. Surface exploration for unknown caves and in-cave exploration for undiscovered areas within known caves are crucial to proper management of cave resources because they produce information on the locations and limits of these resources within the landscape. Cave exploration and other scientific endeavors are thus not competing or mutually exclusive, but complementary disciplines that contribute to the understanding and responsible management of cave and karst resources.

Guidelines to be incorporated into research permits are provided in [Appendix B - Cave Research Guidelines](#).

## **E. CAVE SEARCH AND RESCUE (S&R)**

On the Forest, search and rescue is primarily the responsibility of the specific County Sheriff encompassing that particular District.

Key individuals in these rescue organizations will be given the names and numbers of District personnel to contact during rescue operations. Information on access to keys will be provided.

District personnel responsible for cave management can provide valuable assistance through knowledge of cave location and layout, and resource concerns. Assistance should be provided by cave management personnel through familiarization of S&R techniques, equipment, manpower, and concerns. Recreational cavers that have extensive experience with the caves are also an important resource. They often know specifics of the caves, and of other caves in the area that are relevant to a search management effort. Additional information is available in FSH 2809.15 - MINERALS AND GEOLOGY HANDBOOK. Chapter 25, 3b covers Procedures for Cave Search and Rescue (SAR) and Pre-Planning.

Cave search and rescue operations require personnel with specialized training and equipment. Incident response in the underground environment requires a combination of techniques and gear borrowed from rope rescue, mountaineering, medical, and especially, caving disciplines. In the U.S., cave rescue training is provided by the National Cave Rescue Commission (NCRC), a special commission of the National Speleological Society. The NCRC is not a functioning rescue unit; rather, it provides training opportunities for individuals and organizations interested in cave rescue. The NCRC offers week-long and weekend trainings throughout the U.S. and also provides additional training when requested. More information on cave rescue is at [www.ncrc.info](http://www.ncrc.info).

## **F. CAVE EXPLORATION**

Above-ground searching for caves, or ridge walking, is an appropriate use of Forest land and does not require authorization. New and previously unknown portions of caves have been discovered through excavations. Excavations, however, have the potential to affect biological, archeological, and paleontological values.

Generally, major alterations to caves are not permitted. Requests to locate caves using special excavation techniques (explosives, heavy machinery, removing large volumes of earth) are analyzed and considered on a case-by-case basis in compliance with the Archeological Protection Act and NEPA.

For these reasons, cave exploration using larger equipment will require compliance with the NEPA process, the Archeological Protection Act, and a District special use permit.

Smaller activities which include developing new, enlarging existing, and using buried entrances; digging within caves; and enlarging existing passages do not require authorization.

Upon notification of the location of the exploration site, the Forest has a period to confirm the excavation is not disturbing archeology. This is to meet USFS and the State Preservation Office (SHPO) working/reporting standards.

If archeological artifacts are noted during the excavation process at any time, **the dig shall stop immediately**, and the Forest Service Archeologist notified.

The excavation request should include the location, nature, and duration of the dig. If the effects of the excavation on resource values are none, or can be mitigated, a free permit will be issued. The need for a rehabilitation bond will be considered when the permit is approved. If so requested, locations and nature of excavations will be considered confidential information.

Following an excavation to locate a cave entrance, the condition of the original opening should be mimicked so that the air flow change is minimal and wildlife use is not adversely affected. The surface visual resource should be maintained by replacing fill material.

## G. MONITORING

Monitoring is a very important component to the cave management process since it allows managers to determine the effectiveness of preserving important resources. An outline of monitoring tools and techniques is presented in [Appendix G – Cave Management and Monitoring](#). Not all techniques are required for all caves, but some caves may require many techniques.

Frequency of monitoring will be based on visitation and sensitivity of resources. In general, caves with a very high visitation may require monitoring approximately once a month; caves with moderate visitation may require monitoring once or twice a year; caves with very low visitation may require monitoring once every five years, or as deemed necessary by the District Recreation line officer. A schedule of monitoring caves will be established for each ranger district.

## H. LIMITS OF ACCEPTABLE CHANGE (LAC)

The LAC process identifies the desired condition of a cave resource, defines the amount of change allowed to occur, and establishes the procedures for monitoring and evaluating management performance. (See [Appendix H - Individual Cave Management Files](#)).

LACs may be incorporated into the monitoring of a specific section of a cave. These can be included in the management plan. An example of LAC criteria is "New graffiti will not reach the threshold where it significantly impacts the naturalness of the surroundings".

## J. CLEANUP AND RESTORATION PROJECTS

Cave restoration projects usually include litter removal, graffiti removal and speleothem reconstruction. Volunteers are sometimes sought to assist in these projects. However, Forest Service coordination is required to insure historical graffiti and artifacts are not inadvertently removed, and that glues and

other chemicals used are not toxic to cave life or human visitors. Cleanup and restoration projects can improve the cave experience, but once non-renewable resources are damaged, they cannot be restored to their original value.

## **K. INDIVIDUAL CAVE MANAGEMENT FILES**

Specific management files are developed for caves with high resource, educational or recreational value, hazardous conditions or heavy use. An example of a management file outline is in [Appendix H - Individual Cave Management Files](#). Digital and hardcopy files can be created, updated, stored and managed by cave management partner organizations, volunteers and other stakeholders as directed by the USFS cave representative.

## **L. ADAPTIVE MANAGEMENT**

Management is adjusted for caves if monitoring (identified in LAC or other processes) indicates that:

1. More restrictive management is needed if unacceptable changes are occurring.
2. Less restrictive management is prescribed because impacts are not adversely influencing resources.
3. A new resource is discovered.
4. Surface conditions change that may impact the cave' management level. For example a new road going near the cave entrance.

The District Ranger may decide at that it is time to re-assign the cave to a new classification and management priority, and initiate interim management restrictions (such as a permit, seasonal closure, road access or gate) until a management plan is written. Interim management restrictions are just that, interim. Closures and permits need to be placed in the Cave Management Prescription.

Major management adjustments should include involvement of interested publics.

## **M. KARST MANAGEMENT TECHNIQUES**

In order to protect valuable cave resources, while still allowing surface activities to continue, a variety of management techniques can be used. These may be used in different combinations or individual techniques may be altered to produce a more desirable management. A description of common management techniques is presented in [Appendix J – Karst Management](#).

## APPENDICIES

### Appendix A - Caving Ethics

Caving ethics center on two primary concepts: safety and conservation. Caves have unique scientific, recreational, and scenic values. These values are endangered by both unintentional carelessness and intentional vandalism. Many of these values, once gone, cannot be recovered. The responsibility for protecting caves must be formed by those who study and enjoy them.

1. Mineral formations (i.e., stalactites, stalagmites, crystals, etc.), and other natural, historical, archaeological, or paleontological specimens of any kind are NOT to be touched, damaged or removed from any cave. The only exception to this policy is through specifically authorized separate research and collection permits approved by the District Ranger or Forest Supervisor. Cave research permitting guidelines are described in [Appendix B - Cave Research Guidelines](#). Cave visitors need to consider caves as natural museums and observe, rather than handle, cave resources. Photographs and other non-touching observations that do not harm cave resources are allowed.
2. Due to confined conditions present within caves, cave resources can be easily damaged, and environments created for possible asphyxiation by camping, cooking, smoking, flares, and open fires (other than carbide lamps) and therefore are prohibited within Forest caves or near cave entrances. Minimal stove use is allowed when air quality is not a factor, and team health is a consideration. For example: in a cold cave, using a stove to heat a warm meal for surveying team members is permitted.
3. Travel paths within caves are confined to non-delicate areas. Cave visitors should stay on established cave trails when available, and every effort should be made to prevent damage to easily trampled cave resources. If it is necessary to travel through areas with thick silt, mud or delicate speleothems on the floor, cave visitors need to proceed in single file and follow in established foot falls, or trails. Do not climb on formations and stay low with your head kept down in low ceiling areas to prevent damage to formations. Crossing pristine flowstone floors and destruction of speleothem features in "pushing new leads" is prohibited.
4. Individuals are responsible to remove all equipment, supplies, and other materials taken into the cave at the completion of the trip, including carbide residue if carbide lamps are used. Cave registers and travel aids may be left within caves if approved prior to the trip by the District Ranger. Examples of travel aides that could be approved are bolts and pitons (where safe natural riggings are not available) and plastic surveyor's ribbon used to mark trails through delicate areas. Use of string as a route finding tool is prohibited.
5. Many cave formations and microclimates are dependent on pristine waters. Water quality and quantity alterations may irreparably damage cave resources and ecosystems. Drinking and/or collecting water from caves is prohibited. Cleaning anything, or the use of soap or detergent (including biodegradable) in any cave water is prohibited. Pack-It-In, Pack-It-Out.
6. Delicate balances within the cave's ecological system may be seriously upset by the introduction of human wastes. Human waste, both solid and liquid, must be carried out of the cave and properly

disposed of outside the cave well away from the cave entrance. Use of “pee bottles and WAG bags” is mandatory.

7. Caving groups should be kept to a maximum of six persons in "Primitive, Sensitive and Pristine" caves. Larger group sizes may be allowed if determined in a specific cave management prescription. Larger groups may have difficulty moving through delicate areas without damaging cave resources.
8. A minimum group size of three individuals is recommended in all caves.
9. No gum or tobacco is to be used within caves. These items allow the introduction of foreign microorganisms into the cave environment resulting in an alteration of the native environment.
10. Gloves should be worn while within cave environments as the oils in skin may kill any active growth of cave speleothems (features).
11. Do not disturb bats, or disturb other wildlife. Disruption of wildlife, for example bats and salamanders, causes them to use and waste valuable energy that would otherwise be used to sustain them during critical non-active periods.
12. Pets will not be allowed into caves.
13. When going into caves in more than one area, caving equipment, boots and clothing will be cleaned, washed and disinfected to avoid transporting microbes and other materials from one region to another.

## Safety Considerations

These are some minimum safety considerations to be aware of and follow.

1. A minimum group size of three individuals is recommended in all caves.
2. Before the trip always tell someone:
  - a. Where the group is going
  - b. When the group is expected to return
  - c. Contact the person when the group is out of the cave
3. Each person should:
  - a. Wear a helmet with a chin strap
  - b. Carry three lights, including one light mounted on the helmet
  - c. Wear boots with deep treads
  - d. Carry enough water and to safely visit the cave as well as the distance to and from the cave.
4. Areas in caves with steep drop offs can require ropes. Special training and equipment is needed to be able to safely go down **and come back up**. Training is available through caving organizations such as the National Speleological Society at [www.caves.org](http://www.caves.org)
5. Knee pads and elbow pads are recommended

## Appendix B - Cave Research Guidelines

The following guidelines will be incorporated into research permits as applicable:

1. All research conducted within the Forest requires the submittal of a written proposal and subsequent approval from the appropriate District Ranger or designated cave management resource specialist. The USFS may solicit the assistance of outside specialists in various disciplines in the vetting of cave researchers and proposal analysis. Approval to conduct research within Forest caves will be made on a case-by-case basis after USFS review and acceptance of the research proposal. Proposals must justify the need for the collection of specimens or sampling of other cave resources. Specimens removed from Forest caves as part of research efforts shall be repatriated to the source cave upon completion of research activities or shall ultimately be placed in a suitable public repository capable of proper curation and permanently housing of the specimens. A uniquely numbered USFS scientific collecting permit must be obtained by the proponent prior to initiating any sampling within caves.
2. Researchers should use non-consumptive techniques wherever possible. If it will be necessary to alter or damage cave resources in order to obtain useful scientific data, the researcher is required to include in the proposal an assessment of the potential for and/or level of resource impacts anticipated from the research. The researcher must evaluate the extent to which the research may individually affect cave resources.
3. Researchers will demonstrate, through verifiable experience, competency for working in the cave environment. This is important for both safety of research team members and for the conservation of resources. Researchers without prior or adequate in-cave experience may be accompanied by a Forest Service representative at the discretion of the District Ranger. To minimize collateral damage to cave resources, in-cave research teams should include only those personnel necessary to accomplish research goals. This may include a Forest Service representative at the discretion of the agency. The in-cave research team will be adequately briefed on cave conservation techniques and known and potential resources occurring in the project cave(s). Researchers must stay within limits of designated in-cave trails where they are established, unless permission to visit other areas is permitted by the USFS. Researchers and their team are subject to the Caving Ethics policy outlined in [Appendix A - Caving Ethics](#). All in-cave team members will sign the cave permit issued to the researcher. The principal investigator is responsible for the actions of the entire party.
4. The USFS encourages peer-reviewed journal publication of scientific findings resulting from cave research conducted on the Forest. However, because of the sensitivity of many resources present in Forest caves, the names and locations of some caves are considered proprietary. Researchers must receive guidance from the Forest Service regarding the level of location information that is appropriate for dissemination for each cave mentioned in scientific papers. A USFS sensitive information disclosure review of all manuscripts resulting from research conducted on Forest lands is required prior to submittal for publication. Forest Service will be cited in all scientific papers.
5. As a precautionary measure to minimize the potential for the spread of White Nose Syndrome in bats into Arizona, researchers must comply with current U.S. Fish and Wildlife guidelines regarding

this issue. Any changes in guidelines or protocols that may be instituted during the life of a permitted research activity will automatically require compliance by cave researchers.

6. Research activities must not alter or remove materials from any cave that will result in degradation of a cave without specific written approval.
7. Research conducted within Forest caves will not be allowed to result in the depletion of any cave resource. During the proposal review process the Forest Service will consider the potential for future technologies accomplishing research goals with reduced overall impact to target and/or other cave resources. Every effort will be made to avoid unnecessary publicity or advertisement that could result in increased cave visitation or vandalism, and precipitate otherwise unnecessary salvage operations.
8. Because research provides valuable information that supports management of Forest cave resources and may be instituted to evaluate resources or resolve questions regarding impacts to these resources, research will generally take precedence over recreational use of caves. Such decisions are at the discretion of the District Ranger. If a researcher anticipates conflicts with recreational caving, a temporary closure of the cave may be requested for the period during which field research will be taking place. Typically, this period shall not exceed 90 days. During this time frame only the research group will be given permission to visit the cave. Extensions of the closure exceeding 90 days may be granted, provided progress reports indicate a longer closure is necessary. At the end of the closure, the researcher must ensure that no cave resources are more vulnerable than they were prior to the research activities (e.g., new trails leading to the cave, publicity about the cave's location, open excavations within the cave, etc.).
9. Static cave resources such as archeological, mineralogical or paleontological materials that will be moved, altered or removed for research purposes will be photographed in-situ with an included scale prior to alteration or removal. Multiple photographs that show the relationship of such resources within the context of the undisturbed condition (position) of the object(s) will be taken such that reference points within the cave may be relocated. To ensure that the original location of removed resources can be accurately relocated, the location will be referenced to an unobtrusive permanent survey station or other recoverable, permanent reference point in the cave. Additionally, the original location of the resource may be plotted on an existing map of the cave.
10. The Forest Service may require that a Forest Service representative accompany research activities in some caves.

Other specific conditions may be added as necessary to an individual research or collecting permit.

## Appendix C – Cave Management Categories

All caves on the Apache-Sitgreaves National Forest will be evaluated using the rating system described in [Appendix D – Cave Evaluation and Rating Guidelines](#) and placed in a Cave Management Category. The evaluation and rating guidelines can be used for determining a cave’s significance and management prescriptions. A cave’s management category can change as additional information is acquired on the resource and the surrounding area.

There are two cave management categories. The categories have caves grouped towards management priorities.

**Category 1: Generally Known Caves**

1a – Highly Developed Caves (none currently in Apache-Sitgreaves NF)

1b – Developed Natural Caves

1c – Natural Caves

**Category 2: Lesser Known Caves**

2a – Primitive Caves

2b – Sensitive and Pristine Caves

### Category 1 – Generally Known Caves

Information on Generally Known Caves is available through the greeting personnel at the Forest and District offices.

#### 1a – Highly Developed Caves

There are no Highly Developed Caves currently in Apache-Sitgreaves NF. These are directed access caves with public access. Portions of the cave are developed for public use. These caves are shown on maps or have signs directing visitor access. These caves also may have guided tours and artificial lighting. Regardless of the level of development, encourage public visitation. The caves may have sensitive resources that are protected. Cave management prescriptions are required. These are Directed Access caves.

These are caves with open public access and managed for high impact public use. Management may extend to interpretive information directed towards enhancing public awareness of cave environments and caving ethics. The caves may have sensitive resources that are protected and managed.

In general, cave resources are in a good or better condition. Caves in this category are developed to allow access to visitors without special equipment. Hard surface walkways, steps, handrails, and lighting systems have been installed to maximize the comfort of the visitor. Guides usually accompany large groups and social interaction is high. Interpretive brochures and advertising are common, as well as an admission fee. Parking lots and toilets are usually available on the surface.

#### 1b – Developed Natural

These are caves with public access. These caves are undeveloped, but are suitable for exploration by persons who are properly prepared. In general, these caves contain resources that resist degradation by

moderate levels of recreational use. General public visitation is significant. Cave management prescriptions are required. A permit is not required and the cave is managed as Directed Access.

These are caves with open public access and managed for high impact public use. Management may extend to interpretive information directed towards enhancing public awareness of cave environments and caving ethics. The caves may, but not necessarily, have sensitive resources that are protected and managed.

In general, cave resources are in a good or better condition with some caves being in poor condition as a result of high visitation rates. Caves are minimally developed to allow visitors a relatively safe and informative visit, while not detracting greatly from the natural character of the cave. Examples are trails, steps and barriers that use native materials, enlarged passages, and interpretive and directional signs. Brochures containing educational and interpretive information may also be available. There may be some opportunities for visitors to experience some risk and challenge while encountering natural obstacles (such as uneven floor surfaces and low ceilings), although no special caving equipment is required. Arrangements may be made for a host, and there may be lights and helmets to loan to visitors or visitors provide necessary equipment for safe exploration. Social interactions are typically of family or educational groups, and social encounters with other groups are common. The character of the cave's natural state is maintained (or restored) to provide maximum interpretation and educational benefits. A parking lot, trail to the cave, and possibly toilets may be available on the surface.

### 1c – Natural Caves

These are caves that are in common knowledge but are visited by more physically-fit persons do to the more strenuous aspects of traversing the cave, or a more strenuous approach to the cave entrance. The caves may be more physically challenging. The caves are undeveloped but are suitable for exploration by persons who are properly prepared. In general, these caves contain resources that resist degradation by moderate levels of recreational use. **Public attention will not be directed toward these caves.** They will neither be shown on maps nor discussed in brochures or publications intended for general public distribution. A permit may be required.

Most of the cave resources are in good or better condition. Caves in this category are not developed. Visitors must provide all necessary equipment required for safe exploration. Obstacles within this category of caves usually do not require technical skills such as rock climbing or use of ropes. Visitor registers may be used to monitor visitation and brief interpretive signs may be placed near the cave entrance. Trail markers and monitoring instruments will be used only when needed to preserve fragile resources or warn of hazardous conditions. In general, however, the cave will be kept as natural-appearing as possible. Social interactions are typical of small groups of families or friends, and the chances of encountering other such groups are moderate. Use by experienced recreation cavers will normally represent a minor portion of total visitation. A parking lot and trail to the cave may be available on the surface.

## Category 2 – Lesser Known Caves

Information on Lesser Known Caves is primarily through the Forest or District cave responsible officer. Additional support and information may be available through caving organizations in coordination with the USFS personnel.

### 2a – Primitive Caves

Resources are generally in a good or better condition. Caves in this category are not developed. Visitors must provide all necessary equipment required to safely explore the cave. Technical skills (such as rock climbing) may be required. A visitor has a good chance of experiencing risk and self-sufficiency through the application of caving skills. Visitor registers with conservation messages are likely to be installed just within the entrance, but other management devices will not be installed unless their use is warranted by the presence of fragile resources or extreme hazards. Social interactions are usually between members of a small group of experienced recreational cavers. Social encounters with other groups are very rare because visitation is very low or regulated.

Primitive Caves are undeveloped and are suitable for exploration by persons who are properly prepared. These caves have limited management. **In general these caves contain resources that resist degradation by recreational use.** Management will not include restrictive management techniques. Monitoring will be repeated on a three-year cycle unless a more intensive monitoring program is warranted based on visitation or resources. Resource identification, monitoring, management recommendations and decisions will be documented in a file created for each of these caves.

Restrictive access, permits, seasonal closures and other management methods may be used.

### 2b – Sensitive and Pristine Caves

Resources show no or very little alteration caused by human activity. Most, or all, of the formations are not broken or marred. Introduced dust and mud is limited to established travel routes. Traffic patterns have also been limited to reduce floor destruction. Caves in this category are not developed. Visitors must provide all necessary equipment required for safe exploration. Technical skills (such as rock climbing) may be required, and there is usually an opportunity to experience risk and self-sufficiency. Social interactions are typically between members of a small group of experienced cavers. Visitor encounters with other groups are very rare because visitation is low or regulated.

Sensitive and Pristine caves which by virtue of their high resource/s, recreational values, hazardous conditions, or combination thereof, require a unique management plan. These are caves which require monitoring and management to monitor visitation and resource impact. Management may include restrictive management techniques such as gates, permits or seasonal closures. Monitoring will be repeated on a one year cycle unless a more (or less) intensive monitoring program is warranted based on visitation or resource value. A management plan is required for this category of caves.

Restrictive access, permits, seasonal closures and other management methods may be used.

## Appendix D – Cave Evaluation and Rating Guidelines

This section provides guidelines and information for cave evaluations. The Significant Cave nomination guidelines are in [Appendix E – Significant Cave Designation Process](#). The nomination worksheet is located at [SIGNIFICANT CAVE NOMINATION WORKSHEET](#).

All caves on the Apache-Sitgreaves National Forest will be evaluated using the rating system described below. The Cave classification (Directed Access, Non-Permit, Permit, and Preserve) is determined by the Cave Rating Guidelines, which assign values to various cave resources. The assigned values will be used in determining cave’s classification and management category. These evaluation values will help in making determinations of a cave’s significance as provided by the implementation regulations for the Federal Cave Resources Protection Act of 1988 (FCRPA). If a cave has a Cave Rating Guideline of "Moderate" or greater, in one or more categories, the cave will be considered for designation as significant using the criteria in 36 CFR 290.3(c) and (d) (FCRPA Implementation Regulations 1994).

Experienced cavers are encouraged to participate in the evaluation and monitoring process.

Caves are placed into one of the classes described below based on management objectives consistent with identified cave resource values. As new caves are discovered, they are temporarily managed as Significant until an analysis of resource values is completed. The Cave Rating Guidelines listed below are in accordance with the FCRPA Significant Cave Nomination Process. The Significant Cave Nomination Process worksheet below provides the documentation information.

### Cave Rating Guidelines

All caves will be evaluated using the following rating system. The system allows values of Low (L), Medium (M) and High (H) to be assigned to various cave resources. The assigned values will be used to determine cave classification and will be used in determining cave significance under the implementation regulations of the Federal Cave Resources Protection Act of 1988.

There are two sets of ratings. These are the Resource Value Level, and the Sensitivity Level in that Resource area. The Resource Levels (low, moderate, high) have guidelines for interpretations, and some Sensitivity Level wording. Additional Sensitivity Level wording to help interpretations follows below.

#### BIOLOGICAL RESOURCES

VALUE	EXPLANATION OF VALUE
L	Biological components lacking or of low apparent significance.
M	Biological components present and numerous, with low to moderate sensitivity.
H	Biological components numerous and sensitive to highly sensitive disturbance. Habitat is critical to species survival. The cave contains unique species, or ones found on State or Federal sensitive, threatened, or endangered species lists.

#### HYDROLOGY

VALUE	EXPLANATION OF VALUE
L	Hydrologic components lacking and of low importance.
M	Hydrologic components present but of low to moderate sensitivity.

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H	Hydrologic components important, complex and very sensitive.
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### CULTURAL / HISTORIC RESOURCES

VALUE	EXPLANATION OF VALUE
L	Cultural resources lacking with low potential.
M	Potential for cultural resources moderate or implicated by historic records. Site may be eligible for the National Register of Historic Places.
H	Cultural resources present and sensitive to disturbance. Site eligible for the National Register of Historic Places.

### GEOLOGICAL / MINEROLOGIC / PALEONTOLOGICAL VALUE

VALUE	EXPLANATION OF VALUE
L	Features of significance lacking with some interesting features present.
M	Features present with a moderate sensitivity to disturbance.
H	Features rare, valuable, numerous and of high value. Features sensitive to disturbance.

### EDUCATIONAL OR SCIENTIFIC VALUE

VALUE	EXPLANATION OF VALUE
L	Caves lacking educational or scientific value.
M	Caves with features which can be used for educational or scientific study but are otherwise considered common to the area.
H	Caves providing unusual or unique opportunity for interpretation and educational or scientific study.

### RECREATIONAL VALUE

VALUE	EXPLANATION OF VALUE
L	Cave lacks recreational value with little or no scenic appeal. Characteristics such that a return trip would not be warranted.
M	Recreational value low but receiving moderate use. Scenic values low to moderate.
H	Recreational values, scenic values and use high. A major cave of regional or National significance.

### CAVE SENSITIVITY LEVELS:

1. **LOW:** There is very little if any of the resource present. If the resource is present it is either located away from the frequented cave traverse routes. A person would have to make an effort to locate resource.
2. **MODERATE:** The resource is located on or near frequented cave traverse routes. Inadvertent impact of the resource is likely. Examples include pottery shards located along an in-cave trail, a bat roost beyond a low crawlway that would deter most casual explorers, or historic signatures within easy access to frequented trails.
3. **HIGH:** The resource is listed as MODERATE or HIGH. To avoid impacting the resource, it requires a conscious effort, usually discussed in advance by visitors prior to arriving at the sensitive area. Knowledgeable trip leaders, trip size limits, access limitations and other management techniques apply.

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### CAVE CLASSIFICATIONS

Caves will be placed into one of the following classes based on management objectives consistent with identified cave resource values.

As new caves are discovered they will be temporarily managed as Class 4 until an analysis of resource values is completed.

CLASS	EXPLANATION OF CLASSIFICATION
<b>CLASS 1</b>	<b>DIRECTED ACCESS CAVES:</b> These caves do not have unique hazards to human use, and some are suitable for use by general public. Cave information is provided including directions to the cave.
<b>CLASS 2</b>	<b>NON-PERMIT CAVES:</b> These caves do not have unique hazards to human use, and some are suitable for use by general public. Others require cavers with some experience. Some features/biological resources may be present, but some level of impact will be accepted. Some of these caves will be monitored to determine if any negative effects are occurring over time.
<b>CLASS 3</b>	<b>PERMIT CAVES:</b> These caves have sensitive features and/or severe safety hazards, but can be entered without significant adverse impacts or undue danger by properly equipped and trained cavers. They can only be entered with a U.S. Forest Service (USFS) permit. There will be quite a range of management objectives in these caves. The number of visits may be limited per month for caves with sensitive features. For groups wishing to enter caves with extreme safety hazards, the Forest may request that the group have adequate caving/climbing skills. The permit system will also serve as a monitoring tool.
<b>CLASS 4</b>	<b>PRESERVE CAVES:</b> These are caves that have extremely sensitive physical, biological, or paleontological resources. These caves will basically be left untouched for the foreseeable future. They will become part of a sample of caves that will serve as baseline for undisturbed conditions.

All permit caves will be closed by order of the Forest Supervisor (FSM 2356.1, 2356.2 [4], 2356.31) and entry allowed by permit only. A sign at the entrance of such caves will designate it as closed to visitation without a permit, and indicate the address and phone number where permit information may be obtained. A carrying capacity will be established for each permit and non-permit cave (FSM 2356.1), and allowable uses determined. Permits will be issued only for uses compatible with long-term preservation and protection of cave resources. Except in unusual circumstances, the maximum party size permitted in any permit or non-permit cave will be six persons. A maximum number of visits per month and per year will be established. Each unit will be responsible for issuance of permits for caves under their jurisdiction. (A copy of the USDA Forest Service Cave Entry Permit may be found in the Appendix [CAVE ENTRY PERMIT.](#))

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CAVE RATING SUMMARY

(For determining Cave's Significance and Classification)

CAVE NAME: \_\_\_\_\_

EVALUATED BY: \_\_\_\_\_

CAVE INVENTORY #: \_\_\_\_\_

DATE: \_\_\_\_\_

DISTRICT: \_\_\_\_\_

CATEGORY: \_\_\_\_\_

LEGAL: \_\_\_\_\_

CLASSIFICATION: \_\_\_\_\_

SURFACE SENSITIVITY (L, M, H) \_\_\_\_\_

	Recreation	Education	Biologic	Geologic	Cultural/ Paleo. Resources	Hydrologic	Safety- Hazard	Cave Category APPX C
Resource Level L, M, H								
Sensitivity Level L, M, H								

## Appendix E – Significant Cave Designation Process

The Federal Caves Resources Protection Act of 1988 requires that the Forest Service identify all significant caves on National Forest System Lands.

Although there are many definitions for a cave, the Act defines a cave as “any naturally occurring void, cavity, recess, or system of interconnected passages beneath the surface of the earth or within a cliff or ledge and which is large enough to permit a person to enter, whether the entrance is excavated or naturally formed.”

### What is a Significant Cave?

It is the intent of the Act that significant caves include all caves that have one or more of the following values:

- Biological
- Cultural
- Hydrologic
- Geologic/Mineralogic/Paleontologic
- Educational/Scientific
- Recreational
- Specially Designated Areas

The term Significant was added to provide screening so Federal agencies would not be required to "manage every little hole in the ground" and to screen out cave like features containing "... no resources of any interest to anyone or any recognizable natural resource value"

### Significant Criteria

Some examples of values that meet the significance criteria are listed below.

#### **Biology Criteria:**

The cave provides seasonal or yearlong habitat

- Flora/fauna native to caves
- Species sensitive to disturbance
- State/Federal Sensitive, Threatened or Endangered

#### **Cultural Criteria:**

The cave contains historic properties or archeological resources or other features of importance

- Research important for history/prehistory
- Historical associations
- Historical or traditional significance

#### **Geologic/Mineralogic/Paleontologic:**

- Geologic or mineralogic features that are fragile, or that exhibit interesting formation processes, or that are otherwise useful for study.
- Deposits of sediments or features useful for evaluating past events.

- Paleontologic resources with potential to contribute useful education & scientific information.

**Hydrologic:**

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

**Educational or Scientific**

- Cave offers opportunity for educational or scientific use
- Cave in pristine state; lacks human evidence

**Recreational**

- The cave provides or could provide recreational opportunities or scenic values.
- Total length, volume, depth, pit depth, height, or similar is notable

**Specially Designated Areas:**

All caves located within special management areas, such as Special Geologic Areas, Research Natural Areas, or National Monuments that are designated wholly or in part due to the cave resources found therein are determined to be significant.

**Forms for Nominating and Designating Significant Caves**

The following forms will be used to nominate and designate Significant Caves

## SIGNIFICANT CAVE NOMINATION WORKSHEET

Person or Organization Submitting this Nomination:

Name \_\_\_\_\_

Address \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_ Street City State & zip

Telephone # (\_\_\_\_) \_\_\_\_\_ Date \_\_\_\_\_

Email address \_\_\_\_\_

Person to contact for additional Information:

Name \_\_\_\_\_ Telephone (\_\_\_\_) \_\_\_\_\_

Name \_\_\_\_\_ Telephone (\_\_\_\_) \_\_\_\_\_

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Nomination Information:

Cave Name \_\_\_\_\_

\* Location: State \_\_\_\_\_ County \_\_\_\_\_

\* T. \_\_\_\_\_ R. \_\_\_\_\_ Sec. \_\_\_\_\_

\* Longitude \_\_\_\_\_, Latitude \_\_\_\_\_

\* OR Universal Transverse Mercator \_\_\_\_\_, \_\_\_\_\_

\* OR Verbal description \_\_\_\_\_

\* Topographic Map Enclosed    yes\_\_\_\_ no\_\_\_\_

\* GPS Coordinates Enclosed    yes\_\_\_\_ no\_\_\_\_

\* Cave Map Enclosed            yes\_\_\_\_ no\_\_\_\_

Administering Federal Agency \_\_\_\_\_

Name and address of agency field office where cave is located

Description of Cave:

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\* Information marked with an (\*) is considered confidential under (section 5, Federal Cave Resources Protection Act, 1988) and is not subject to public disclosure under the Freedom of Information Act (Section 552 of Title 5 U.S. Code).

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A cave must meet one or more of the following criteria to be eligible for designation as a significant cave. If you circle "yes" for one or more of these criteria, please explain why in the remarks section. If desired, you may attach additional materials that will support your conclusions.

**YES NO Biota:** The cave provides seasonal or yearlong habitat for organisms or animals or contains species or subspecies of flora or fauna native to caves, or are sensitive to disruption, or are found on State or Federal sensitive, threatened, or endangered species lists.

Description \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**YES NO Cultural:** The cave contains historic properties or archaeological resources or other features that are included in or eligible for inclusion in the National Register of Historic Places because of its research importance for history or prehistory, its historical associations, or other historical or traditional significance.

Description \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**YES NO Geologic/Mineralogic/Paleontologic:** The cave possesses one or more of the following features: (1) Geologic or mineralogic features that are fragile, or that exhibit interesting formation processes, or that are otherwise useful for study. (2) Deposits of sediments or features useful for evaluating past events. (3) Paleontological resources with potential to contribute useful educational and scientific information.

Description \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**YES NO Hydrologic:** The cave is a part of a hydrologic system or contains water that is important to humans, biota, or development of cave resources.

Description \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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YES NO **Recreational:** The cave provides or could provide recreational opportunities or scenic values.

Description \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

6. **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.

YES NO

Description \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Additional Information (optional) access, concerns, public Knowledge:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## Significant Cave Finding/Decision

Name of Cave: \_\_\_\_\_

Forest Service Cave Identification Number: \_\_\_\_\_

Background: The Federal Cave and Resources Protection Act of 1988 (16 U.S.C. 4301-4309) directs the Secretary of Agriculture to prepare and maintain a listing of significant caves. The criteria for listing of significant caves in 36 Code of Federal Regulations Part 290. To qualify for listing as a significant cave, a cave must meet one or more of the criteria.

Finding/Decision: After careful review of the information submitted with the nomination, it is my finding that \_\_\_\_\_ Cave:

\_\_\_\_\_ Qualifies for listing as a significant cave. It meets the following criteria:

- \_\_\_\_\_ Biota
- \_\_\_\_\_ Cultural
- \_\_\_\_\_ Geologic/Mineralogic/Paleontologic
- \_\_\_\_\_ Hydrologic
- \_\_\_\_\_ Recreational
- \_\_\_\_\_ Educational/Scientific
- \_\_\_\_\_ Specially Designated Area

\_\_\_\_\_ Does not qualify for listing as a significant cave.

Comment: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

As prescribed in 36 CFR, Part 290.3(g) this decision is not subject to further administrative appeal.

\_\_\_\_\_  
Forest Supervisor

\_\_\_\_\_  
Date

Role of the Authorized Officer

- Receives listing recommendations from internal staff and partners.
- Verifies questionable data relevant to the evaluation process by consulting with the nominator, internal staff, or consultants. The nomination may be returned to the applicant for more information if there is inadequate information from which to make the listing decision.
- Makes final listing decision.
- Notifies nominator and internal staff of finding.
- Returns all nomination materials to originator for caves not determined to be significant.
- Maintains a log for tracking of each nomination.
- Transmits a copy of the log to the Regional Cave and Karst Program Lead
- Takes necessary measures to ensure the confidentiality of cave information.

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- Provides for interim protection of significant caves until they can be incorporated in the agency *Land and Resource Management Plan*.
- Ensures that significant caves are scheduled for inclusion in the *agency Land and Resource Management Plan*.

### **Confidentiality (36 CFR 290.4)**

- All locations submitted will be confidential
- No copies of nomination materials
- “No Forest Service employee shall disclose any information that could be used to determine the location of a significant cave or a cave nominated for designation unless the authorized officer determines that disclosure will further the purposes of the Act and will not create a substantial risk of harm, theft, or destruction of cave resources.”

## Appendix F - General Inventory Procedures

Information on caves located during the cave inventory process is to be handled confidentially and should include the following:

1. Map location or legal description.
2. Brief description of the cave (i.e., total length, type of passage, etc.)
3. Resources within each inventoried cave will be identified and a brief description written. In most cases this is done at the time of inventory. However, inspection by the cave coordinator, or another adequately trained person, may be required if it is suspected that important resources were not identified. The checklist of identifiable resources is provided below:
  - a. Recreation Resources
    - Evidence and extent of human visitation
  - b. Biological Resources
    - Evidence of bat use
    - Evidence of other animal use
    - Observations of invertebrates
    - Naturally introduced organic material
    - Roots
    - Fungal, lichen, moss, or algal growths
  - c. Geological Resources
    - Passage or features which display geological events not exposed at the surface (i.e., preserved lava flows, exposed faults, etc.)
    - Secondary mineral deposits
    - Unconsolidated sediments (i.e., pristine mud or silt floors)
    - Re-solutional features (i.e., scallops, box work, etc.)
    - Cave climate and air flow
    - Aesthetics
  - d. Cultural / Paleontological Resources
    - Artifacts which have been left in the cave 50 years or more (includes Historic graffiti)
    - Natural objects (i.e., logs, rocks, etc.) which were brought into the cave at least 50 years ago.
    - Human-caused alterations to the cave which are at least 50 years old
    - Fossils embedded in rock
    - Animal remains (bones, middens, scat, etc.)
    - Sediment deposits rich in pollen
  - e. Hydrological Resources
    - Lakes, rivers, or other substantial amounts of water
    - Seasonal freezing or flooding

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- Cycles of entering and exiting water levels
- f. Safety / Hazards
  - Hypothermia
  - Toxic gases
  - Flooding
  - Drop-offs, unstable entrances, cave interiors, rocks, etc.
  - Diseases
  - Poisonous animals
- 4. A map of the cave and preliminary monitoring can be done initially or at a later date.
- 5. Management Recommendations (optional)

## Appendix G – Cave Management and Monitoring

Below are management and monitoring elements that are useful in determining the cave's management practices. Monitoring items are accumulated on caves as resources become available. Experienced volunteers are encouraged to participate in data collection, maintenance, and inventory.

### Management elements include:

- Visitor Registers
- Conservation Messages and Interpretive Signs
- Brochures and Handouts
- Cave Maps
- Cave Gates
- Cave Trails
- Permits and Group Size Limits
- Guides or Trip Leaders
- Seasonal and Sensitive Area Closures
- Road Closures, Upgrading and New Construction
- Restrict Information Dispersal
- Take No Action
- Permit and Preserve Caves (Class 3 & 4 Caves)

### Monitoring elements include:

- Photo Transects (photo monitoring)
- Impact Mapping
- Wildlife Monitoring
- Cave Climate Monitoring
- Hydrological Monitoring
- Air Quality Monitoring

## Management Elements

### Visitor Registers

Registers are a simple and relatively effective technique of determining visitation to all classes of caves. Visitor registers consist of a notebook contained within a biologically inert and weatherproof container. Visitor register data may be validated using a trail counter or similar electronic device if more accurate information is required. For estimation purposes 80% sign-in is assumed for most registers and less sign-in is assumed for heavily visited caves.

### Conservation Messages and Interpretive Signs

Conservation messages can be placed within visitor registers, at appropriate locations, where use of signs would affect the cave's management objectives.

Signs may be installed near the entrance or within caves to increase visitor appreciation of cave resources and/or suggest appropriate caving techniques which will foster visitor safety and resource protection. Over-use of signs should be avoided so as not to interfere with the natural appearance of the cave.

### **Brochures and Handouts**

Handouts for "Developed Natural" and "Natural" caves could be distributed to persons with specific information requests. Handouts for "Primitive" and "Sensitive and Pristine" caves could be given out with cave use permits should visitation need to be regulated. Brochures and handouts would reference caving ethics and hazards for specific caves.

### **Cave Maps**

Detailed cave maps are required for other techniques of monitoring such as photo transects and impact mapping. A useful scale for cave maps used for monitoring is 1" = 20'.

### **Cave Gates**

Gates may be used to control access to certain caves (FSM 2356.2 [5]). Cave gates may be required to protect sensitive resources and maintain or change the cave management category. Gates detract from the entrance area of a cave. When it is determined a gate is required, the gate will be designed and installed to allow free passage of bats, small animals, air, and water into or out of the cave. Gates will be constructed using the best designs available and located for maximum wildlife acceptance and maintain original airflow levels to the cave.

Seasonal closure of caves for protection of hibernating bats or bat maternity sites will be used as appropriate and closure dates will be determined by the Forest Service Wildlife Biologist.

A Closure Order by the Forest Supervisor is required prior to the installation of a cave gate (FSM 2356.1, 2356.2 [4], 2356.31). At a minimum, an interim cave management plan is needed. A cave management plan is preferred. A permit system to enter beyond the cave's gate may be implemented when appropriate.

### **Cave Trails**

Development of cave trails may be used to protect fragile resources. Cave trails can be used to restrict damage to pristine floor surfaces or fragile non-renewable deposits (i.e., bones). Cave trails should be visible and easy to follow. Examples of cave trails currently in use include rocks lining either side of the path, plastic surveyors' ribbon strung between short PVC stakes lining both sides of the path and reflective tape on small plastic stakes lining both sides of a trail.

### **Permits and Group Size Limits**

Permits, trips, and Group Size limits are primarily set to prevent resource damage and maintain management objectives. Permits limit the frequency of use, and the number of people who can use the cave at one time. Group size limits are required where large groups would have difficulty moving through areas with fragile cave resources without causing damage. Usually, only one group at a time will receive a permit.

### **Guides or Trip Leaders**

Guides or trip leaders can be used as a means to ensure proper use of a cave, limit the use of a cave or educate users about caves. A guide system for an un-gated cave could lead to increased public visitation. Outfitter guide permits should be considered carefully before issuing.

### **Seasonal and Sensitive Area Closures**

Some caves may be closed seasonally to protect visitors from seasonal hazards (Eg. flooding) or conserve sensitive wildlife habitat (Eg. bat maternity or hibernacula areas).

### **Road Closures, Upgrading and New Construction**

Roads which lead to, or pass near, a cave's entrance will be considered for closure if closure of the road would help protect fragile resources, maintain the cave's management objectives, or from a safety aspect for shallow cave roofs. Careful evaluation of construction or upgrading of roads leading to or very near a cave will be required to maintain safety to individuals and equipment, and to protect the natural setting of the cave.

### **Restrict Information Dispersal**

Restricting Information dispersal is accomplished at multiple levels. For example, sensitive areas may be best protected by maintaining control of the information.

### **Take No Action**

Taking no action is the most common method of cave management. Until a need is determined, leaving the cave in its natural state is the recognized best practice.

### **Permit and Preserve Caves (Class 3 & 4 Caves)**

Permit and Preserve Caves are considered unsuitable for exploration by the general public either because of their pristine condition, unique resources, or extreme safety hazards. These caves will be managed to minimize impacts, and ensure public safety through the utilization of cave management techniques. These are caves which have had closure orders implemented to support restrictive management techniques. A management plan will be required for these caves. Monitoring schedules will be determined, and public participation from the caving community and other appropriate organizations will be encouraged in the assessment of determining is protective management techniques such as seasonal closures, permits, or gates are warranted.

## **Monitoring Elements**

### **Photo transects (photo monitoring)**

Most vulnerable or indicator resources within caves are photographed periodically to determine if these resources are being impacted. The photos are dated and numbered. The view point and direction of each photo should be located on a map of the cave.

### **Impact Mapping**

Impact mapping is completed to locate sensitive resources and impacts. Two types of impact mapping can be used:

- 1) To locate and describe fragile resources and impacts on a map of the cave.
- 2) To delineate areas of the cave's floor and ceiling which are impacted and non-impacted. These maps can be periodically reviewed to determine if resources are disappearing or impacted areas are increasing in extent.

Both types of impact maps can be generated using a detailed map of the cave.

### **Wildlife Monitoring**

Systems to determine periods of wildlife use, type of wildlife use and numbers of individuals are established where warranted. In particular, sites used by bats for hibernation or maternity roosting should be monitored. Wildlife monitoring must not interfere with wildlife use, and is coordinated through a Forest Wildlife Biologist.

### **Cave Climate Monitoring**

Temperature, humidity, evaporation rate, and air flow can be critical to wildlife use, mineral growth and preservation of artifacts. Cave climate is monitored where it is suspected human activities might alter cave climate temperature, humidity and evaporation. Activities likely to affect cave climate include gating, blockading or enlarging the entrance, operating machinery within the cave, altering water flow through the cave or excessive visitation.

### **Hydrological Monitoring**

Monitoring of water flow or water levels within caves is developed if this information is important to visitor safety or maintenance of flow rates, critical mineral growth or wildlife. Water quality within caves is monitored if contamination is likely. Establish a baseline.

### **Air Quality Monitoring**

CO<sub>2</sub>, methane, and other life-threatening gases are known to be present in dangerous levels within some Forest caves. If a problem is identified air quality monitoring will be considered.

## Appendix H - Individual Cave Management Files

There are two files that are kept on the caves on the Forest; the Master File and the Public File.

The **Master File** contains the complete information on the cave. The Master File contains FOIA exempt, research, sensitive information, Cave Management Plan, and other information on the cave. The **Public File** contains managing information as it relates to the public. This information will vary depending on whether the cave is in Category 1 – Generally Known Caves or, Category 2 – Lesser Known Caves.

Public File information for Category 1 caves may be available at the Forest or District front desks. All other cave related information is available through the Forest or District line officer.

### MASTER FILE

The Master File should be maintained under positive control by the Forest or District line officer. The Access to the Master file is through approval of the line officer. Signed MOUs, challenge cost-share agreements, and/or Non-Disclosure Agreements (NDAs) will help the line officer in determining file access and information distribution.

Information detailing locations, maps, sensitive resource values, and monitoring records will be kept separate from the public information files on cave management. Use of sensitive information files will normally be restricted to Forest personnel dealing directly with cave management, and provided to interested individuals and organizations, such as caving groups, scientists, and recreationists, who have interests in managing the cave resources. Other access to sensitive files will be approved by the Forest Supervisor, the District Ranger and Resource Specialist responsible for caves as needed. Information contained within cave files is not subject to standard USFS records retention policies.

Master File should contain the following information and data:

- 1) Introduction (Background and natural history)
  - A) When found, by whom, other people present, how located, how and why named.
  - B) Significant cave nomination form and findings/status of nomination including cave number.  
Confidential records.
- 2) Identification of cave location
  - A) Topographic map location, survey map (plan view), and vertical section. Global Positioning System (GPS) coordinates or other detailed directions for reaching the cave entrance such as: road log by tenths of a mile, walking distance both horizontal and vertical, approximate walking time at an average pace from the parking area, and pedometer log and step log.
- 3) Resource identification and evaluation
  - A) Detailed description of major features of the cave, including speleothems, fauna, flora, biological, hydrological, geological, archaeological, paleontological, etc.
- 4) Hazards
  - A) Detailed description of hazards present within the cave and/or reaching the cave entrance. Include recommended equipment and procedure for reaching, entering, and exploring the cave.
- 5) Management Category and Classification designation

- 6) Priority including whether active or passive management is needed
- 7) Initial management.
- 8) Monitoring (including LAC's)
- 9) Management adjustment using LAC guidelines
- 10) Pictures
  - A) Should show the entrance to the cave and at least the major areas and features of the cave. The individual who took the pictures and when taken should be marked on the pictures.
- 11) Trip Reports
- 12) Miscellaneous (rescue plan, special restrictions, etc.)
- 13) Entry Authorization Permit if any.

**14) Cave Management Plan**

- A) The Cave Management Plan should contain:
  - Cave Name
  - Goals and objectives
  - Location/setting - if management plan allows
  - Administrative and Background information:
    - Administrative actions
    - Closure Orders (open, closed, seasonally open, only parts of the cave open, etc.)
    - Withdrawals,
    - Permit requirements (number of trips limit, group limit size, key distribution, deposit and return procedures
    - Restrictions, etc.
  - Description of resources
  - Identification of issues
  - Management prescriptions/recommendations
  - Maps
  - Monitoring element
  - Safety/Emergency Rescue plan
  - Research - data trends
  - Photos that document critical planning elements
- B) The Cave Management Plan **should not** contain:
  - Directions to the Cave, location or GPS information if the cave is in Category 2 or Classified has Permit and Preserve Cave Management.
  - Sensitive information

**PUBLIC FILE**

The Public File should contain non-sensitive cave information from the cave's management Plan. Only the location of Generally Known Caves (Category 1) classified as "Directed Access" will be available to the public.

For **Directed Access** caves this includes:

- Cave Name

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- Cave Access Status (opened, closed, seasonally open, only parts of the cave being open, etc.)
- A current copy of any closure order (biology, vandalism)
- If gated, key distribution and return policy, including deposit if required.
- Group limit size if any (LAC determined).
- Trip frequency limit if any (LAC determined). For example permits up to 3 trips per calendar month.
- Equipment necessary for safe exploration (for example vertical caves), and whether equipment inspection is needed prior to the trip.
- List of “areas to be aware of”. For example, List of safety and conservation items that are needed for which the explorer should be aware. For Example “Do not disturb any bats.”, “Stay out of the water.”, “Do not touch formations.”
- Cave’s History if known.

**Note - Directions and location information is confidential and cannot be provided to the public or included in FOIA packages if the cave is in Category 2, or Classified has Permit and Preserve Management.**

## Appendix J – Karst Management

Karst is a landscape formed from the dissolution of soluble rocks and is characterized by sinkholes, caves, and underground drainage systems. It is usually associated with limestone, dolomite and gypsiferous rock types.

Karst Management is the protection of karst systems and individual karst features such as cave entrances with sustainable forest practices. The primary focus is to manage surface and subsurface karst resources by applying appropriate management practices on the surface karst environment.<sup>3</sup> The Federal Cave Resources Protection Act (FCRPA) is the defining authority for caves, and the associated surface karst.

The primary challenges of karst management are addressing the complex and three-dimensional nature of karst. A specific challenge is to manage the potential for karst hydrological systems to transport water, nutrients, soil, and pollutants into and through underground environments.

Karst is a unique, non-renewable resource that has many values. These include:

- Caves, including passages not accessible by humans
    - FCRPA significance criteria (hydrology, archaeology, paleontology, biology, mineralogy, and recreation)
  - Biological Values
    - Forest productivity
    - Unique plant and animal habitats
    - Fisheries
  - Hydrological Values
    - Water quality
    - Water quantity
  - Mineralogical Values
    - Mineral deposits
    - Oil and gas
  - Scientific Values
    - Geography/Geology
    - Archaeology/Paleontology
  - Cultural Values
    - Traditional Cultural Properties
  - Economic Values
    - Timber
    - Livestock Grazing
    - Recreation
-

- Industrial products

In order to protect valuable cave and karst resources, while still allowing surface activities to continue, a variety of management techniques can be used. These may be used in different combinations or individual techniques may be altered to produce a more desirable management.

### **Key Karst Management Objectives**

To promote sustainable forest practices on karst landscapes and achieve the following objectives, while minimizing impacts to timber supply and operational costs:

1. Maintain the ability of karst landscapes to regenerate healthy and productive forests after harvesting
2. Maintain the surface and subsurface habitats of karst ecosystems to ensure biodiversity
3. Maintain the natural flows and water quality of karst hydrologic systems
4. Maintain the natural rates of air exchange between the surface and subsurface
5. Implement the different levels of karst inventories to determine their relation to karst management (Order 4 to Order 1).
6. Reduce soil erosion around and into karst features.
7. Reduce sedimentation into karst features.
8. Protect significant surface karst features (e.g., sinkholes, sinking streams, springs, cave entrances) and subsurface karst resources (e.g., caves, underground streams, subterranean fauna)
9. Provide recreational opportunities where appropriate.

### **Karst & Volcanic Ecosystem Inventory Levels**

NOTE: See also FSM 2880 for geological resource inventories for caves and karst ecosystems. Order 1, 2, 3, and 4 inventories

A key aspect of effective karst management is conducting karst inventories and assessing the vulnerability of the karst. There are three levels of karst inventories. Each level has increasing requirements for data collection and evaluation. They are:

1. Reconnaissance
2. Planning
3. Karst field assessments

**Reconnaissance-level** karst/volcanic ecosystem inventory maps are not yet completed on the forest. Reconnaissance-level karst inventories are used to identify areas of potential karst development. Reconnaissance level inventory maps should be checked prior to any forest development on potential karst terrain. A recommended scale is 1:250,000. Order 4 Inventory

**Planning** inventories are used to delineate karst unit boundaries, and determine the distribution and variation of karst development over a landscape or watershed. They are also used to identify the extent of karst and non-karst catchment areas.

Planning-level inventories are used for landscape-level forest development planning and to guide the location and scope of karst field assessments. This is probably like order 3 or Order 2 inventory, 1:100,000 to 1:24,000 scale.

**Karst & Volcanic Ecosystem Field Assessments** focus on evaluating the karst attributes of a relatively small karst area of interest (e.g., timber sale or road). Karst field assessments can be done prior to any road construction or forest harvesting on karst terrain. Typically they should be done prior to or during site-level planning. Karst features include caves, sinkholes, disappearing streams, and underground drainage systems. Though the soluble bedrock is usually limestone, dolomite, or gypsum, karst features regularly occur on the surface above. The Mogollon Rim region and Colorado Plateau demonstrate many of these features.

**All karst is vulnerable.**

Karst Field Assessments determine karst vulnerability using a systematic procedure that evaluates three major criteria: epikarst sensitivity, surface karst sensitivity, and subsurface karst potential. Other factors considered for assessing vulnerability include soil texture, and unique or unusual flora/fauna or habitats. These ratings are used to guide appropriate forest management practices for the karst based on the level of vulnerability.

The data from a karst field assessment also identifies “significant” surface karst features where specific protective measures (e.g., buffers) are recommended for forest operations.

Karst field assessments also identify sinking and losing streams/sinking watercourses where special riparian management considerations are recommended.

A karst field assessment can be triggered under the following circumstances:

- An area is underlain by carbonate bedrock.
- A development is proposed on non-carbonate lands located within the contributing drainage basin of known or suspected carbonate units. (In this case, the karst field assessment would be carried out on the known or suspected karst units located downstream of the proposed timber sale.)
- Reconnaissance-level maps indicate that an area may be underlain by karst.
- A planning-level inventory has identified karst polygons with moderate or high vulnerability potential ratings in or around the area.
- There is prior knowledge of karst in or around the area.
- Karst features have been identified in the area.

- Forestry activities, such as salvage, spacing, pruning or commercial thinning are planned on an area known or suspected to be underlain by carbonate bedrock.

The karst field assessment primarily evaluates surface features, but can also include subsurface evaluations if caves are encountered. Karst field assessments examine such things as:

- The location, classification and significance of surface karst features
- Epikarst development and soil thickness
- Density of surface karst features
- Characteristics of streams
- The inspection and mapping of caves
- Subsurface karst potential
- Unique or unusual flora/fauna/habitats
- Geomorphic hazards.

A subset of these assessment categories may be adequate to address the site management needs when caves are not noted.

The data collected during a karst field assessment are used to stratify the karst area of interest.

## Management Objectives and Practices for Significant Karst Features

### Karst Assessment Criteria

Assess the significance of karst features is conducted during a karst field assessment.

Methods and criteria for determining the significance of surface karst features:

- Dimensional characteristics
- Level of connectivity between the surface and subsurface
- Dye tracing
- Hydrological characteristics
- Geological, biological, scientific, archeological, historical, cultural and educational values
- Recreational and commercial values
- Rarity and abundance
- Visual quality.

If the significance of a karst feature is unknown, or has not yet been determined, it is recommended that the feature be treated as significant until a determination can be made.

If caves are encountered determine the significance of the caves using the Cave Management Plan. Significant caves are protected under FCRPA. The significance criteria are summarized by the following:

- Significant hydrological, archaeological, paleontological or cultural values
- Bat hibernacula, maternity colonies, or rare cave-dwelling organisms
- Scientifically important climatological or geomorphological sediments
- Significant recreational opportunities

- Well-developed decorations
- Unique intrinsic values (e.g., large dimensions, unusual configuration, rare/uncommon location).

Since determining the significance of caves requires subsurface inspection and mapping, it should only be done by personnel with specialized knowledge, training and experience. Organizations with experienced individuals and equipment are available and willing to help with this effort.

### **Significant Karst Feature Protection**

A primary impact to significant karst features surface disturbance, and the resulting debris and silt being washed into the karst and caves. It is recommended that buffers be established for the following significant karst features:

- Significant cave entrances
- Above significant caves (depending on depth using the 45 degree principle)
- Significant surface karst features
- Significant karst springs
- Unique or unusual karst flora and fauna habitats.

The following current management practices and mitigation activities are recommended within all karst buffers:

- A buffer zone is of 300 feet is established on the karst feature perimeter.
- Soil erosion and siltation is a primary concern. Mitigation measures, such as placement of soil barriers and traps to reduce disturbance and siltation should be considered.
- Reduced disturbance practices will be used for 1000 feet upstream in the drainages of large karst features.
- The upstream water course buffer will be 100 feet wide.
- No roads or skid trails should be located within karst buffers
- No trees should be felled within karst buffers except to remove safety hazards or reduce significant forest health risks. Where felling is required, consider the following:
  - Use partial cutting.
  - Fall away from karst features.
  - Leave felled timber on the ground to help provide coarse woody debris and an intact forest floor.
  - If felled timber must be removed (e.g., significant forest health concerns) avoid yarding over or through karst features.
- Take measures to ensure that human wastes, petroleum products, herbicides, litter and other pollutants do not contaminate karst buffers by following proper storage and transport procedures.
- Sinkholes large enough to create their own microclimate should be managed similarly to a significant cave entrance, with a buffer of 300 feet to maintain interior microclimatic conditions.

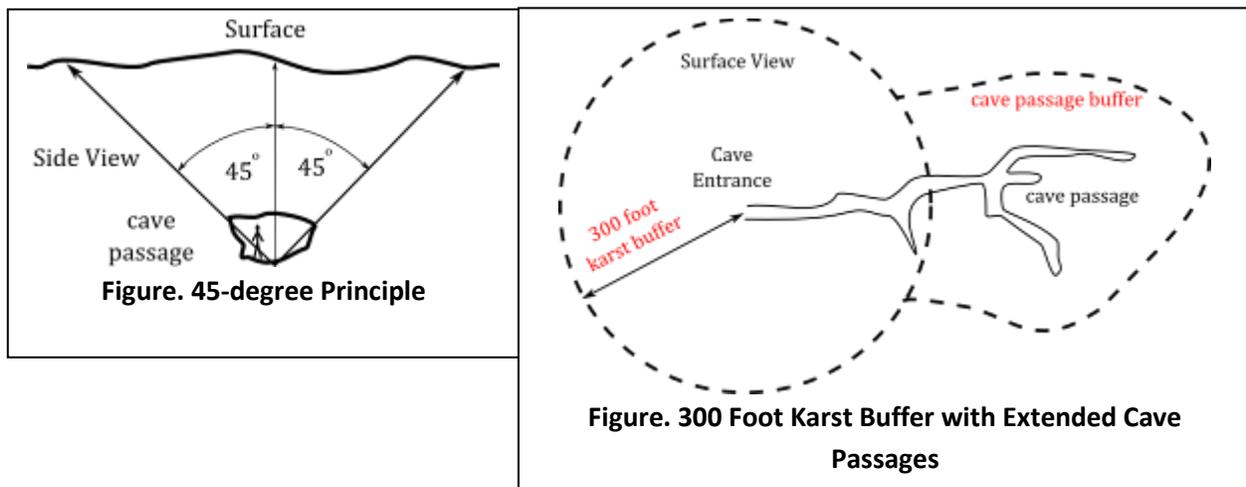
### **Surface Management Above Significant Cave Entrances**

The following section summarizes the management objectives and recommended current management practices for significant cave entrances. As these are only brief summaries, you should also check out more detailed information in the Cave Management Plan.

The following is a summary of the management objectives designed to protect significant cave entrances. Buffers should:

- Leave a minimum 300 foot buffer extending outward from the mouth of the cave entrance. In the case of a significant entrance contained within a sinkhole, the buffer should extend from the top of the sinkhole.
- Drainages into caves and other karst features should be protected.
- Maintain the microclimate around significant cave entrances
- Maintain stable habitat conditions for any flora or fauna inhabiting the cave entrance or cave
- Prevent logging debris from entering significant cave entrances
- Provide a measure of aesthetics/recreational experience for cave entrances with high recreational values.
- Leave understory vegetation along buffer boundaries, and green trees in the opening to help maintain interior microclimatic conditions and inhibit the encroachment of edge species into the buffer.
- For buffers around entrances of caves known to contain bat hibernacula or maternity colonies, or threatened or endangered species, follow the recommendations in the Endangered Species Act of 1973.
- The size of the management area for specialized harvesting practices can be projected to the surface using the 45-degree principle.
- **NOTE:** Of particular concern is when karst features are, or highly likely to drain into significant caves. When significant caves have karst buffers, these buffers should be expanded (at least considered) to the karst features that are likely to have hydrological connection.

The 45-degree principle is a 45 degree angle up to the surface above known passages.



Practices recommended for cave entrances that do not meet significant cave criteria include:

- Fall and yard away from the cave entrance as much as possible.
- Remove any slash and debris that falls in or around the cave entrance, provided removal does not cause further disturbance.

- Retain non-merchantable trees, advanced regeneration, wildlife trees, and other vegetation within the management zone.
- Reduce ground disturbance

### Riparian Management for Sinking and Losing Streams/Sinking Watercourses

This section includes the management objectives and recommended current management practices for sinking and losing streams/sinking watercourses.

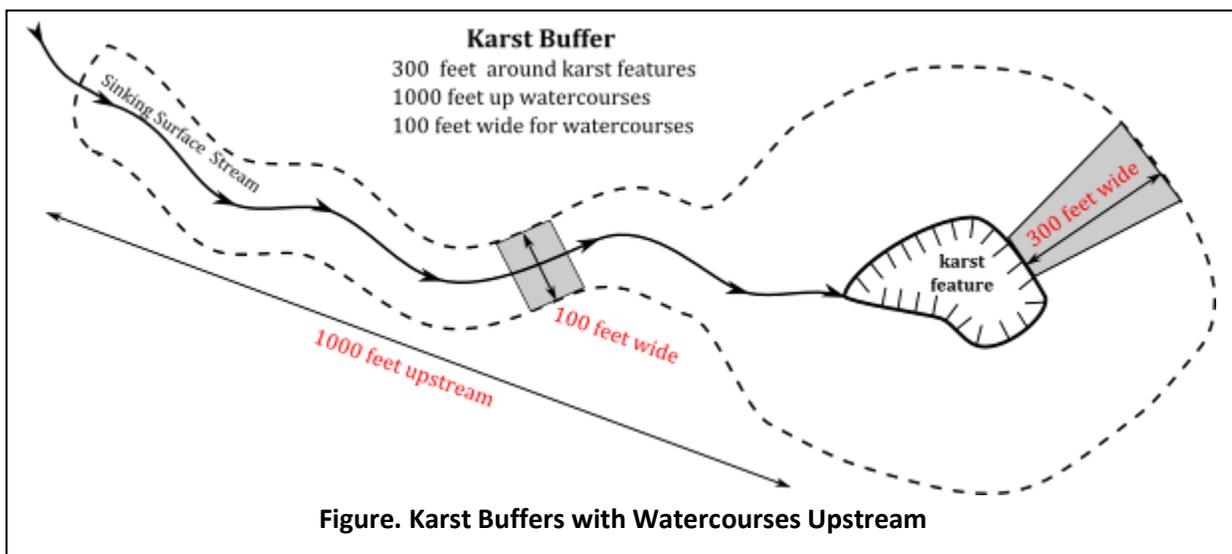
On karst terrain, surface streams that do not sink or lose water to the subsurface can be managed using the default standards for riparian management as specified by the U.S. Fish & Wildlife Service. Streams/watercourses that sink or lose water to the subsurface may require special riparian management considerations, as they have the potential to transport sediment and debris into sensitive subsurface karst environments.

#### Management Objectives

- Maintain water quality and quantity
- Limit the introduction of sediment, fine organic material or woody debris into subsurface environments within the range of natural conditions.
- Include Forest riparian management objectives.

#### Management Practices and Mitigation Activities

- Reduce sediment, organic material and woody debris that can be transported downstream, accumulate and clog karst features.
- Reduce the introduction of fine sediment and organic material into subsurface cavities and caves.
- Retain trees with roots embedded in the watercourse edge.
- Fall and yard away from the watercourse to the fullest extent possible.
- Avoid yarding across the watercourse.
- Remove slash and debris that inadvertently enters the watercourse.
- Retain trees and other vegetation (understory, shrubs, herbs) within the watercourse buffer.



These recommended practices, or others deemed appropriate to achieve the management objectives, should be applied for a minimum of 1000 feet upstream of the recipient feature, or to the point where the watercourse is no longer readily identifiable.

Many sinking and losing streams can spend a large part of the year as a dry stream channel, only flowing when the subsurface karst system backs up and during major storms or runoff events. When these types of streams flow, they can contribute major sources of sediment, organic material and other debris that are readily transported underground.

### **Karst Management Practices for Grazing**

**Cave/Karst Description for Grazing:** The allotment is located in karst terrain, a landform that is characterized by underground drainage through solutionally enlarged conduits that may contain sinkholes, sinking streams, caves, and springs. Sinkholes leading to underground drainages and voids are common. These karst features, as well as, occasional fissures and discontinuities in the bedrock, provide the primary sources for rapid recharge of regional groundwater aquifers.

Sinkholes and cave entrances collect water and can accumulate richer organic materials and soils. This, in conjunction with the more stable microclimate near a cave entrance, supports a greater diversity and density of plant life which provides habitat for a greater diversity and density of wildlife.

The caves also provide habitat for a number of animal species. Cave entrances support communities of raptors, rodents, mammals, and reptiles, while the interior of the caves may support a large variety of troglobitic, or cave-dependent, species. The troglobitic species have adapted to the cave environment which has a constant temperature, constant high humidity, and total darkness. Some of the caves in the area contain easily disturbed bat colonies.

Many of the caves in this area contain fragile and very delicate speleothems such as stalactites, aragonite and gypsum crystals, and speleogens. Cave passages or karst drainage may exist very close to the surface creating the possibility for slow subsidence or sudden collapse.

**Grazing Impacts on Caves and Karst:** Cattle grazing in karst areas, particularly near sinking streams or springs, can cause a great increase in the turbidity and type of organic materials carried into a cave system. Large increases in the manure content and other materials entering the cave ecosystem can cause a deterioration of the water quality by changing the nutrient value and PH of the water thus becoming harmful to the wildlife in the cave. It can also pose a health threat to any human visitors to the cave.

**Grazing Mitigations:** Range improvements such as **fencing** off fragile recharge and riparian areas can help reduce the impacts to these sensitive zones. Drinking troughs and salt licks can be placed away from recharge areas and springs outside the fenced off area. Buffer size guidelines are listed in [Riparian Management for Sinking and Losing Streams/Sinking Watercourses](#) above.

NOTE: Suggest use of monitoring and adaptive management to evaluate and mitigate grazing impacts to stream courses in karst terrain.

### **Karst Management Practices for Road Construction**

There are four areas of road construction and maintenance in karst areas for native surface roads. Paved surface roads have additional requirements. For non-sealed roads, the karst management practices are:

- Locating roads, landings and quarries
- Constructing roads, landings and quarries
- Maintaining roads
- Deactivating and rehabilitating roads.

### **Road Location in Karst Terrain**

A major area of potential conflict with road locations is the fact that logging roads are often located along ridges and areas of higher elevation to achieve easier access to timber and maximum deflection for harvesting. There are two issues – the need to protect exposed epikarst and the need for efficient access to timber. The following mitigation activities are recommended:

- Use existing roads, landings and quarries wherever possible.
- Avoid locating roads over sinking streams. These streams may be intermittent and only active during rain events or snow runoff.
- Locate quarries on a site-specific basis while accounting for the nature of karst resources in the area.
- Locate roads and landings to minimize deep cuts and fills.
- Locate roads, landings and quarries to maintain natural surface drainage patterns as much as possible.
- Avoid locating roads, landings, quarries, spoil sites and/or equipment turnaround/turnout sites within karst and cave buffer zones.
- Avoid facilitating public access to sensitive or hazardous karst areas.
- Locate storage areas for fuel and other hazardous materials off karst terrain.

### **Road Construction, Landings and Quarries**

The following mitigation activities are recommended:

- Flag karst features within/near the operating area.
- Modify or cease operations if previously unidentified karst features or values are encountered during road, landing or quarry construction, and notify the Forest Service district office.
- Avoid construction activities during periods of heavy rainfall.

- Avoid importing ballast from non-karst terrain.
- Stabilize disturbed areas, such as quarries, to reduce erosion potential.

If road location within the Karst Buffer Zone is unavoidable, these mitigation activities should be employed:

- Directionally fall and yard right-of-way trees away from roadside karst features.
- Pile surplus construction material away from surface karst features, and streams leading into features.
- Avoid drilling or blasting near karst features, or if this is not possible, use mitigative strategies such as delayed charges, blasting mats, etc.
- Use overlanding road construction methods near roadside karst features.
- Avoid fueling or servicing machinery near surface karst features and cave entrances.
- Keep the wheels or tracks of equipment away from roadside karst features. If not possible, keep wheels or tracks parallel to the edge of features.
- Avoid removing gravel or fill from roadside depression features.
- Minimize clearing of roadside vegetation.
- Use sediment traps and vegetated infiltration areas to prevent road runoff entering exposed epikarst, surface karst features, cave entrances or sinking streams.
- Complete construction activities so that cut and fill slopes have time to revegetate before the wetter months of the year.
- Reduce road runoff by leaving roads on exposed carbonate bedrock unsealed. Use geotextile materials if sedimentation of groundwater is a potential hazard.
- Direct runoff from bridge decks away from stream channels and into vegetated cover along stream banks.
- Minimize potential sedimentation problems by using geotextile materials on bridge decks and around bridge ends.
- Avoid the use of chemically treated wood for bridges.

### **Maintaining Roads**

The mitigating activities for road maintenance are:

- Maintain silt/sediment traps and drains to function properly, and dispose of accumulated debris away from karst features and watercourses leading to features.
- Minimize accumulations of graded materials along roadsides where sediment could enter features or watercourses leading to features.
- Avoid the use of chemical dust suppressants, de-icing agents and salt.
- Locate storage areas for fuel and other hazardous materials off karst terrain or at least on low vulnerability karst areas (except for daily fuel requirements).
- Avoid fueling or servicing machinery near surface karst features and cave entrances

### **Road Deactivation and Rehabilitation**

The following mitigation activities are recommended:

- Use strategies to prevent sedimentation when permanently deactivating roads (e.g., armoring drainage ditches).
- Do not use quarries as storage sites for logging debris/wood waste, refuse, petroleum products, etc.
- Deactivate quarries upon completion of operations.
- Take measures to make deactivated quarries inaccessible to the public (e.g., berms, water bars).
- Restore natural surface drainage patterns as much as possible to maintain the quantity and quality of subsurface flows.
- Avoid road rehabilitation during sustained or heavy rainfall.
- Avoid road deactivation or rehabilitation when disturbances to roadbeds may be detrimental to karst values in the area.
- Keep the wheels or tracks of equipment away from the edge of roadside karst features. If not possible, keep wheels or tracks parallel to the edge of features.
- Avoid introducing soil or bedding materials into karst features.
- Complete rehabilitation operations with sufficient time to allow for adequate revegetation before the wetter months of the year.

### **Karst Management Practices to Timber Harvesting**

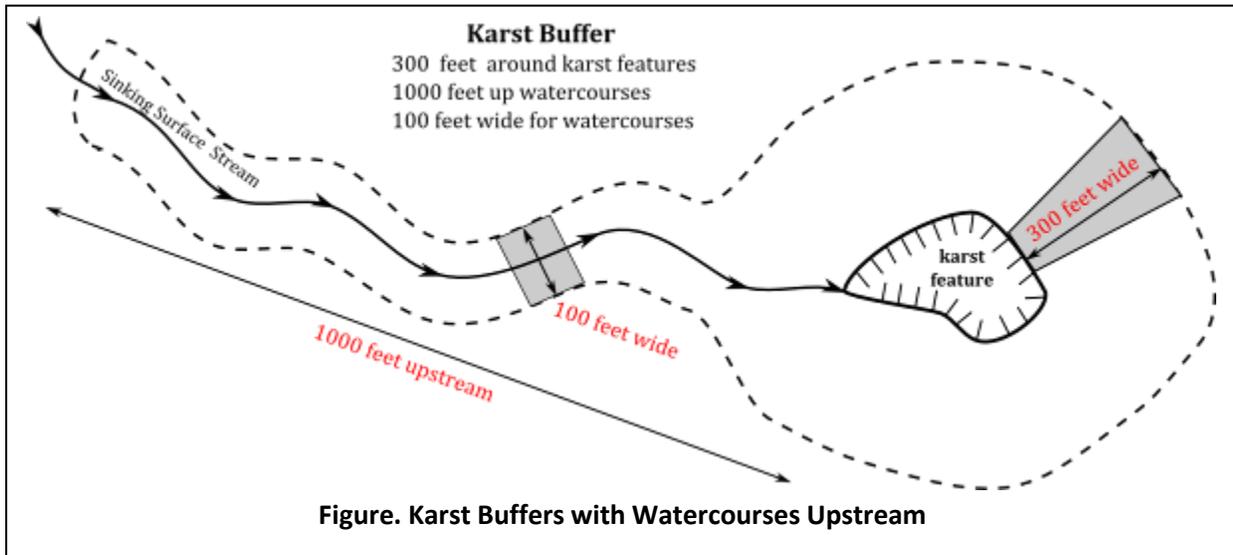
Karst inventory levels are defined in [Karst & Volcanic Ecosystem Inventory Levels](#). Karst areas require buffer zones to mitigate the impact to sensitive subsurface aquifer and ecosystem. The guiding size of the buffers are:

- 300 foot buffer around the upper edges of the karst feature
- 1000 foot buffer upstream for watercourses recharging karst features
- Upstream buffers should be 100 feet wide
- The buffer is extended above significant cave passages

Limited exceptions to this may occur in special situations where some form of site-specific intervention is required to help protect forest or karst resources. These include:

- Forest health issues such as insect infestations
- Thinning for fire protection
- Human health related issues

Forest management activities that may be required on karst areas should be conducted in consultation with a karst specialist, the Forest Hydrologist, and/or other relevant resource agencies.



Harvesting operations will occur outside of karst areas. The recommended BMPs are:

Karst Topography	Current Management Practices
<p><b>Karst Mitigation Activities</b></p>	<ul style="list-style-type: none"> <li>• 300 foot buffer zones around karst perimeters.</li> <li>• Water course disturbance reduction methods used 1000 feet up drainage, 100 feet wide.</li> <li>• The buffer will be extended above significant cave passages.</li> <li>• Timber felling away from karst features and drainages.</li> <li>• Reduced ground disturbance including:                         <ul style="list-style-type: none"> <li>○ Skidding through drainages reduced or avoided.</li> </ul> </li> <li>• Harvesting equipment to reduce ground disturbance is used. Conduct safety briefings for appropriate personnel.</li> <li>• Flag karst features and/or values within the operating area.</li> <li>• Consider restricting harvesting to periods when the likelihood of heavy rains and high runoff are low.</li> <li>• If previously unidentified karst features or values are encountered, modify or cease operations until the features or values can be assessed. Notify the local Forest Service district office.</li> <li>• Minimize exposing mineral soil as much as possible.</li> <li>• Locate storage areas for fuel and other hazardous materials off karst terrain or at least on low vulnerability karst areas (except for daily fuel requirements).</li> <li>• Keep the wheels or tracks of equipment at least 300 feet from the edge of karst features. If not possible, keep wheels or tracks parallel to the edge of features.</li> <li>• Take appropriate measures to correct inadvertent water diversions to prevent sediment transfer into subsurface environments.</li> <li>• Avoid fueling or servicing machinery near surface karst features and cave entrances. Take appropriate measures if spills occur.</li> </ul>

	<ul style="list-style-type: none"><li>• Avoid piling slash on exposed, well-developed epikarst.</li></ul>
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### **Karst Management Post-harvest Operations**

Post-harvest operations should be modified to accommodate the vulnerability of a karst area. Post-harvest operations include:

- Minimize the impact of herbicides and fertilizers on karst groundwater systems
- Minimize soil disturbance from mechanical activities of site preparation.
- Minimize the impact of burning, particularly on karst with shallow organic soils
- Reforestation
- Minimize the obstruction or clogging of karst features with spacing and pruning debris.
- Monitor BMP and mitigation activity effectiveness.

### **Karst Catchment / Recharge Area Management**

The primary karst catchment management objective is to maintain the water quality and quantity of streams that sink or lose water into downstream karst units.

Karst catchment areas are comprised of all lands contributing surface runoff and/or diffuse recharge to the karst system, including upstream non-karst areas.

Karst catchments are delineated during karst inventories. Dye tracing can be used to determine subsurface flow paths, particularly in cases where a subsurface hydrological connection cross surface drainage divides.

**UNITED STATES DEPARTMENT OF AGRICULTURE  
APACHE-SITGREAVES NATIONAL FOREST**

**CAVE ENTRY PERMIT**

**After permit is signed by ALL participants, permission is granted to enter the following cave on the date specified.**

Cave Name & Number	Date(s) of entry	Key #	Issued by
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The group leader will accompany the group at all times, will assume full responsibility for the actions of the group, and is responsible for the timely return (two working days) of the cave permit, gate key, and any other issued materials.

**Your signature indicates you have read, understand, and agree to all conditions of this permit.**

1.	_____	_____	_____
	<b>Trip Leader Signature (18 years old minimum)</b>	<b>Age</b>	<b>Complete Mailing Address</b>
	_____	_____	_____
	<b>Print Name</b>		<b>Phone Number</b>
2.	_____	_____	_____
	<b>Signature</b>	<b>Age</b>	<b>Complete Mailing Address</b>
	_____	_____	_____
	<b>Print Name</b>		<b>Phone Number</b>
3.	_____	_____	_____
	<b>Signature</b>	<b>Age</b>	<b>Complete Mailing Address</b>
	_____	_____	_____
	<b>Print Name</b>		<b>Phone Number</b>
4.	_____	_____	_____
	<b>Signature</b>	<b>Age</b>	<b>Complete Mailing Address</b>
	_____	_____	_____
	<b>Print Name</b>		<b>Phone Number</b>
5.	_____	_____	_____
	<b>Signature</b>	<b>Age</b>	<b>Complete Mailing Address</b>
	_____	_____	_____
	<b>Print Name</b>		<b>Phone Number</b>
6.	_____	_____	_____
	<b>Signature</b>	<b>Age</b>	<b>Complete Mailing Address</b>
	_____	_____	_____
	<b>Print Name</b>		<b>Phone Number</b>

**This permit authorizes the permittees to enter and explore the specified cave. **Removal of any materials, rocks, or artifacts from the caves and digging or other surface disturbing activities are prohibited.** Persons signing this permit accept responsibility for informing themselves of the inherent dangers of exploring undeveloped caves, and accept full responsibility for their conduct and personal safety. **The permittees shall hold harmless and forever discharge the Federal Government and its employees of and from any and all claims, demands, lawsuits, damages, and liabilities. The Federal Government assumes no responsibility for any mental or physical injury or damages resulting from entering or exploring the above cave. This is a wild cave with no development.****

Apache-Sitgreaves National Forest - Cave and Karst Management Guide

**CONDITIONS OF THIS PERMIT:**

1. This permit is valid only on the date(s) specified for cave entry.
2. This permit and cave gate key must be returned to the Forest Service even if your trip is canceled. Permit and key must be received and/or mailed within two working days of your **scheduled** trip.
3. The permittee copy of this permit must be in your possession while visiting the cave. All party members must sign their names, provide a phone number and address on the **permit** before entering the cave. This permit is valid only for those listed on the permit.
4. **For safety reasons, a minimum number of two (2) people are required to enter a cave.**
5. To reduce resource impact, the maximum number allowed to enter **a cave** at one time is six (6).
6. Smoking in the cave is prohibited.
7. For your safety, please leave the gate key in a safe location just inside the gate, known to all members of your party. The location should be far enough inside the gate entrance such that the keys are out of reach and view from the outside.
8. The trip leader is responsible for keeping the cave locked while exploring the cave, and locking the gate upon exiting.
9. All materials carried into the cave by the group must be removed and properly disposed of. The disposal of any human waste within caves is prohibited. No pets are allowed in the cave. Please remove any litter you find.
10. The permittees are responsible for their own caving equipment. Each member of the group shall have **at least** three (3) separate light sources, one attached to a hard hat with non-elastic chinstrap, and non-skid footwear.
11. In accordance with the Code of Federal Regulations and the Federal Cave **Resources Protection Act of 1988**, removal or destruction of any natural formations, minerals, rocks, biological/wildlife and archaeological resources in or near caves on the National Forest is prohibited.
12. It is agreed that there will be no publicity regarding the specific location of this or any other National Forest cave without written permission from the District Ranger.
13. Use of pictures or any other information secured on this trip is for personal enjoyment only. Commercial or research use will require written approval from the District Ranger.
14. Failure to comply with any of the listed requirements may result in curtailment of future cave access privileges **or in some cases, legal prosecution.**

NOTICE: If you find the gate broken or tampered with, any evidence of forced entry, or if you notice damages to any cave resources, please report the information to the Forest Service. If you find anyone doing damage to a cave, please get all possible information (names, times, vehicle descriptions, license numbers, etc.) and report the incident to the Forest Service as soon as possible.

We hope your trip will be a safe and enjoyable one.

**COMMENTS and/or SUGGESTIONS:**

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## Appendix L - Terms and Definitions

**Best Management Practices (BMPs)** – Recommended methodologies used to implement the defined goals and objectives.

<b>Cave<sup>4</sup></b>	Any naturally formed void, cavity, recess, or system of interconnected passages which occurs beneath the surface of the earth or within a cliff or ledge including natural subsurface water and drainage systems, which is large enough to permit a person to enter, whether or not the entrance is naturally formed or manmade. The term "cave" shall also include any natural pit, sinkhole, or other feature, which is an extension or component of a cave.
<b>Cave Life</b>	All life forms, including plants and vertebrate or invertebrate animals endemic to caves or which commonly use caves during the completion of their life cycles.
<b>Cave Resource</b>	The cave itself and any material occurring naturally in caves, including sediments, paleontological deposits, minerals, speleothems, water, cave life, and other natural resources.
<b>Caver</b>	One who explores caves as a recreational pursuit. Synonyms: potholer, spelunker.
<b>Code of Federal Regulations (CFR)</b>	CFR 36 Part 290 pertains to cave management.
<b>Developed Cave</b>	Any cave or cave site that has been developed for the benefit of the public. This includes items such as construction or improvement of access roads, parking areas, sewage and sanitation facilities, trails, safety barriers, interpretive displays, and other similar features designed for public use.
<b>District</b>	Subdivisions of the Forest into management (Ranger) areas.
<b>Epikarst</b>	The upper surface of karst, consisting of a network of intersecting fissures and cavities that collect and transport surface water and nutrients underground; epikarst depth can range from a few inches to tens of feet.
<b>45-degree principle</b>	A 45 degree angle up to the surface above known cave passages.

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<sup>4</sup> [p://www.fs.fed.us/cdt/main/fsm\\_2350\\_2300\\_2009\\_2.pdf](p://www.fs.fed.us/cdt/main/fsm_2350_2300_2009_2.pdf)

**Federal Cave Resources Protection Act** of 1988 (16 U.S.C. 4301-4309; 102 Stat. 4546) (**FCRPA**) – The act secures, protects, and preserves significant caves on Federal lands for the perpetual use, enjoyment, and benefit of all people

**Forest Service Manual (FSM)** The Manual listing policies by which the Forest Service administers the land.

**Hydrological Setting** All natural components of a particular hydrological system, including areas of recharge, drainages, watersheds, regional movement of water through a particular geographical and topographical area, and the related structural components and geological formations through which it moves or by which it is controlled.

**Karst** A geological landform existing in area where the predominate shaping process is controlled by soluble bedrock, usually calcareous nature. Karst landscape is characterized by closed depressions, disappearing streams, and solutional shaping. Classical karst drainage is vertical and underground.

**Karst Field Assessment (KFA)** Site level karst inventory and vulnerability assessment. The major karst attributes assessed during a KFA include: karst unit boundaries; surface karst features; epikarst sensitivity; surface karst sensitivity; karst roughness; streams and hydrology; subsurface karst potential; and unique or unusual karst flora and fauna.

**Level of Acceptable Change (LAC)** Determining what changes are “acceptable” considering the use loading on the resource. The LAC process identifies the desired condition of a cave resource, defines the amount of change allowed to occur, and establishes the procedures for monitoring and evaluating management performance

**Pristine Cave** A cave containing resources which have significant values that can be easily damaged, disturbed, or destroyed. Trails causing the least impact have been established and maintained. Active, conservation oriented cave management has been established to reduce damage.

**Pseudo Karst** A topography that resembles karst but that is not formed by the dissolution of limestone; usually a rough-surfaced lava field in which ceilings of lava tubes have collapsed.

**Sensitive Cave** A cave containing resources which have significant values that can be easily damaged, disturbed, or destroyed.

<b>Sink, Sinkhole (USA)</b>	General term used for closed (to humans) depressions. They may be basin, funnel, or cylindrical shaped.
<b>Speleogen</b>	Relief features on the walls, ceilings, and floor of any cave or lava tube which are part of the surrounding bedrock, including but not limited to anastomoses, scallops, meander riches, petromorphs and rock pendants in solution caves and similar features unique to volcanic caves.
<b>Speleologist</b>	A scientist engaged in the study and exploration of caves, their environment, and their biota.
<b>Speleothem</b>	Any natural mineral formation or deposit occurring in a cave or lava tube, including but not limited to any stalactite, stalagmite, helectite, cave flower, flowstone, concretion, drapery, rimstone, or formation of clay or mud.
<b>Wild or Undeveloped Cave</b>	As contrasted to a developed cave which lacks formal improvements to facilitate public use. Trails are user-developed or nonexistent; parking, sanitation, interpretive displays are lacking.