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National Cave and Karst Research Institute

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# INCORPORATING CAVE AND KARST MANAGEMENT INTO THE FOREST PLAN REVISION PROCESS OF ARIZONA FORESTS

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## **Abstract**

Arizona National Forest land managers have a multitude of tasks and priorities; historically, caves and karst management has not been amongst the priorities receiving any significant allocation of resources. When caves and karst management is not included in the Forest Plan, even when large and significant cave and karst areas exist, active cave and karst management often falls below the waterline of available manpower and resources. Additionally, there is entropy associated with normal changes in personnel assignments and new staff coming onboard. When combined with a general lack of written policies and guidelines, these personnel transitions lead to unnecessary degradation of the karst and caves. Three areas impacted by lack of caves and karst policy include timber management (sales and thinning), water recharge protection (buffer zones), and cave management (under the recreation department).

This paper is intended for Forest managers whose units contain significant karst and caves, but have no allocated staff in these areas. The paper presents clear and acceptable guidelines and policies that can be implemented in a uniform manner. Integral to these guidelines is the inclusion of Karst and Cave Areas as a separate land use designation in the Forest Plan. With karst listed as a land use designation in the Forest Plan, references to a separate Cave and Karst Management Plan document can be made. Additionally, the Cave and Karst Management Plan can be updated without having to go through the extremely long Forest Plan amendment process.

The Arizona National Forest Cave and Karst Management Plan has been created to address this need. It is located at <http://centralarizonagrotto.webstarts.com/index.html> and provides clear management tools for the Forest cave resources.

## **Introduction**

Arizona has six National Forests, and all six of those forests are revising their Forest Plans from their prior 1980s era releases (refer to Table 1 for details). These revised plans are in various stages of the writing, review (both internal and public), and acceptance processes. All six Forests have significant caves, and at least four of the Forests have large, significant, and active karst. None of these six Forests have staff dedicated to karst or caves and the management and issuance of cave gate keys is primarily handled by cavers. **Of the three Arizona Forests that have published new Forest Plan drafts in 2012 and 2013 for public review, a total of one page has been dedicated to cave and karst management.** This appears in large part to be due to:

1. Lack of cave and karst management awareness
2. Lack of public/caver/academic input before and/or during the drafting of the new Forest Plans.
3. Lack of clear karst management procedures that allow implementation of other stakeholder goals (e.g. timber harvesting) while addressing the resource mitigation needs. Table 1 lists the status of the existing Arizona forest plans - May 2013.

## **Arizona Forest Karst**

To date, cave and karst management has received very little priority in Arizona forests. Some examples of the recent status of cave management from several of Arizona's Forests may clarify the issue. The Kaibab National Forest Plan draft of April 2012 includes the words "karst" 8 times, and "cave" 27 times. As indicated in Figure 1, below, the Northern unit of the Kaibab National Forest is dominated by a massive karst plain, which is likely to be the recharge zone for the many springs in Grand Canyon National Park – including the spring that feeds their tourist facilities. Most of the references in the Kaibab National Forest plan are

**Table 1.** Arizona Forest Plan Statuses – May 2013.

Table 1 – Arizona Forest Plan Statuses

National Forest	Year of Signed Forest Plan	Forest Plan being updated?	Forest has Significant Caves/Karst?		Caves/Karst in Current Forest Plan?	Caves/Karst in New Forest Plan? *		Where in Planning Process?
			Caves	Karst		Caves	Karst	
Apache-Sitgreaves	1996	Yes	Yes	Yes	No	Yes?	Yes?	90 day comment complete 5/2012
Coconino	1987	Yes	Yes	Yes	No	Yes?	Yes?	Writing
Coronado	1986	Yes	Yes	No	No	Yes?	Yes?	Prep for 90 day comment
Kaibab	1985?	Yes	Yes	Yes	No	1 page		90 day comment complete 4/2012 - near final draft
Prescott	1986	Yes	Yes	No	No	No	No	90 day comment complete 11/2012
Tonto	1985	Yes	Yes	Yes	No	Yes?	Yes?	Writing

\* As of 5/31/2013

oriented around White Nose Syndrome mitigation strategies. All of the instances of “cave” and “karst” are contained within the:

- Table of Contents.
- One page of text in the document.
- The FCRPA summary listed in the Authority section.

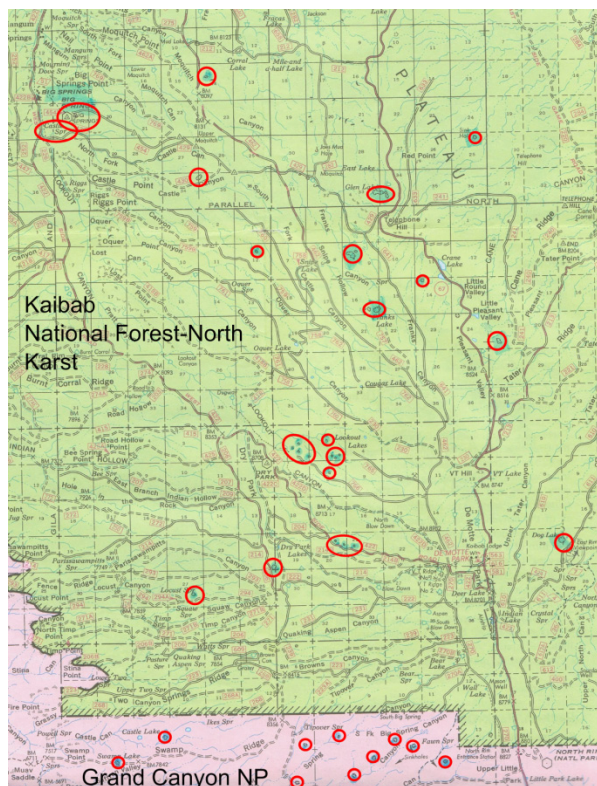
Figure 1 highlights several of the North Kaibab National Forest karst features. These may include the primary recharge areas for Grand Canyon National Park’s tourist facilities (both North and South rim).

The Prescott National Forest Plan draft of August 2012 has no references to caves or karst. While it appears that Prescott National Forest does not have large karst, it does have large, significant caves that serve as the primary water sources for nearby communities.

The Apache-Sitgreaves National Forest Plan draft of January 2013 has no reference to “karst”, although caves are named and included when addressing aspects of resource management. Caves are included in lists for management when addressing habitats, archeological, biological and geological features. Figure 2 lists several of the Apache-Sitgreaves National Forest’s larger karst features. There are many more which are not large enough to be referenced individually on maps at this scale.

### Addressing the Forest Cave and Karst Management Issues and Needs

Arizona Forests do not currently have staff whose primary job descriptions include cave and karst management.

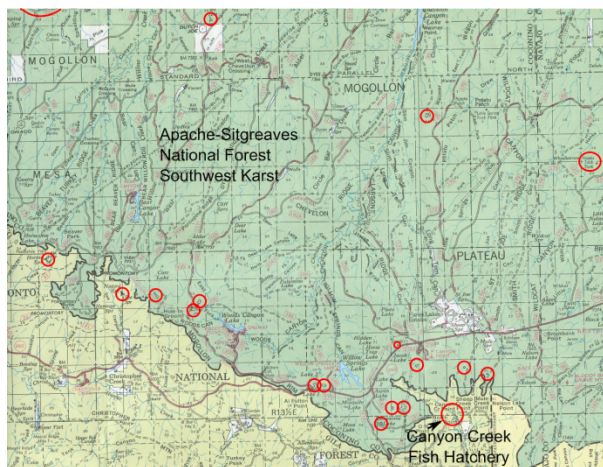


**Figure 1.** North Kaibab Karst Larger Features  
Large karst features circled. Grid lines are section boundaries.

These forests rely on their specialists in timber sales, grazing, biologic, geologic, and archeological, disciplines to understand and prescribe appropriate procedures when their individual disciplines intersect cave and karst management tasks. Considering that staff turnover happens from time to time, new personnel can benefit from documents that are written in such a way as to be used at multiple levels. Ideally, one reference document could be used for training, research proposal policies, file management (public and controlled), and public involvement and participation.

Given the various issues and needs illustrated above, the primary needs for improving cave and karst management on National Forests lands are:

1. Listing karst and caves as a separate land use designation, with corresponding goals and objectives clearly defined in the Forest Plan.
2. Providing clear policies and guidelines that address timber harvesting methods, non-sealed road construction, and other surface management on karst.



**Figure 2.** Southwest Apache-Sitgreaves Larger Karst Features Large karst features circled. Grid lines are section boundaries.

3. Providing a clear, Forest-level cave management plan that describes the “how to” of cave management.

Note that item 1) above is needed at the Forest Plan level, while items 2) and 3) are more appropriately included in a cave and karst management document.

To address these needs, the Arizona Cave and Karst Management Plan (Keeler and Bohman, 2013) draws from and highlights relevant portions of federal laws and statutes including the United States Code(USC), the Code of Federal Regulations (CFR), and Forest Service Manuals (FSM) (US Forest Service, 2009). In addition to these regulatory requirements, the Arizona Cave and Karst Management Plan has drawn upon the following sources for guidance:

- Tonto National Forest (AZ) Cave Management Plan (unsigned draft) (Dixon, 1991; US Forest Service, 1992).
- Coconino National Forest (AZ) Cave Management Plan (unsigned draft) (Bodenhamer, 1990).
- Sierra Vista Ranger District (Coronado National Forest, AZ) Cave Management Plan (draft) (US Forest Service, 1990).
- Lincoln National Forest (NM) Cave Management Plan (US Forest Service, 1995)
- Tongass National Forest (AK) Land and Resource Management (US Forest Service, 2008)
- Karst Inventory Standards and Vulnerability Assessment Procedures for British Columbia (British Columbia Ministry of Forests, 2003)

- Karst Management Handbook Training, Ministry Forests and Range, British Columbia (CAN) (British Columbia Ministry of Forests, 2003)
- Strategy for Cave Management XYZ National Forest (Gifford Pinchot NF) (1994) - USFS Region 6 (Nieland, 1994).

The Tonto National Forest, Coconino National Forest and Sierra Vista Ranger District documents made it to the draft level, but were not signed as amendments to their respective Forest Plans. These documents remained as informal guidelines for management.

## Three Possible Forest Management Plan Improvements

### Create the Karst and Caves Land Use Designation in the Forest Plan

For Forests that have significant karst and caves, it is needed for Caves and Karst Areas to be included as a specific land use designation in the Forest Plan. If this is achieved, Goals and Objectives can be included in the Forest Plan. Both Surface and cave management approaches for each of the areas of concern (FCRPA related) can reference a Cave and Karst Management Document.

The creation and inclusion of this new land use designation is an attempt to institutionalize an increased awareness of cave and karst resources in each forest. The current methods for transferring knowledge, relying heavily upon word of mouth, are inefficient, and do not adequately protect the resource. One example of this breakdown in communication and knowledge transfer happened recently on the Tonto National Forest. As part of a region-wide initiative to improve forest health through targeted thinning projects, one project in particular was proposed that happens to encompass most of the watershed for the largest single karst system in Central Arizona. While an Environmental Assessment (EA) was dutifully performed, there was only a minor mention of sinkholes, and no mention of the significant cave and karst region that is included in the area. This initial omission was further exacerbated by the lack of open two-way communications between the caving community and the USFS personnel at the district level. Fortunately, the District Ranger and members of the caving community have since been able to hold productive meetings on the ground to revise the specific guidelines of that timber sale and thinning activity.



Unfortunately, these sorts of examples are all too common. As a first step to prevent future occurrences, the creation of a separate land use designation for karst and caves will improve the visibility of these resources at the highest levels of Forest management. Once the management needs of caves and karst have visibility, personnel can be assigned to manage those needs as part of their regular responsibilities. Then when personnel are regularly assigned to manage these resources, the likelihood of unintentional oversights such as the examples listed above will be greatly diminished.

### **Provide Clear Karst Management Policies and Guidelines**

After reviewing karst management papers and receiving comments from NCKRI and a Forest hydrologist, it became apparent that clear Forest management policies for karst needed to be specifically described to improve the odds of their implementation. These policies and guidelines needed to complement existing forest management documents and processes, so a separate Karst Management Appendix was added to the Arizona National Forest Cave and Karst Management Plan. Within that karst management appendix, the various sub-categories include:

- Field assessments
- Ground disturbance mitigation
- Buffer zones
- Providing clear policies and guidelines

Karst buffer guidelines have been established with a focus on timber harvesting, and have been reduced to three numbers that allow for adjustments when caves extend outside the surface buffer zones.

- 300 foot reduced ground disturbance buffers around karst features
- 100 foot wide reduced ground disturbance corridors upstream to karst features
- 1000 feet long reduced ground disturbance corridors upstream to karst features
- Buffer adjustment when a cave extends outside the surface buffer zones

The size and significance of the karst feature may affect the guideline distances above.

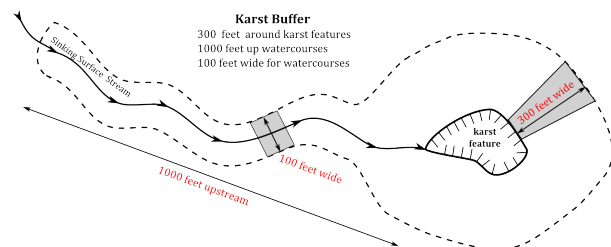
Figure 3 shows the karst buffer guideline distances.

Figure 4 shows the cave extension buffer outside the surface karst buffer. Figure 5 shows a surface management rule of thumb (The 45 Degree Guideline) to be used over significant cave passages. The 45 Degree Guideline becomes especially relevant when the cave is deep below the surface. It is also helpful when the cave continues for a substantial distance beyond the entrance buffer zone.

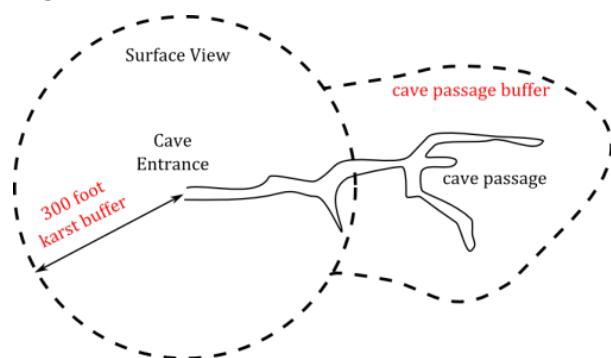
### **Provide a forest level cave management plan**

Provide a forest level cave management plan that describes the “how to” of cave management.

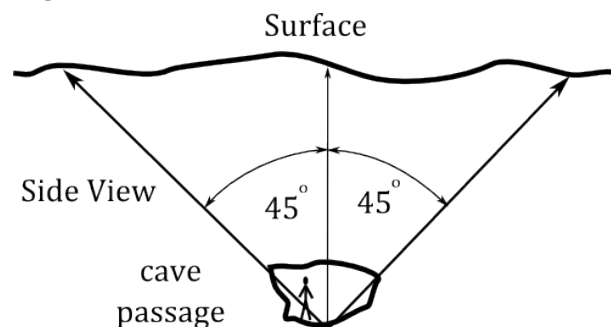
National Forests are staffed by competent personnel that come from many disciplines, but cave management is not likely to be in the majority of the backgrounds of those personnel. What has become obvious is the need



**Figure 3.** Karst Buffer Guideline Distances.



**Figure 4.** Cave Extension Buffer.



**Figure 5.** 45 Degree Guideline.

for a document that Forest Service personnel can use as a “how to” for cave management. The document needs to cover guidelines and policies that the recreation officers and their field technicians can implement, use as a training guide, and use as a reference when approached by researchers and volunteers.

The 45 page Arizona National Forest Caves and Karst Management Plan (Keeler and Bohman, 2013) is an attempt to cover these needs and is located at <http://centralarizonagrotto.webstarts.com/index.html>. The document contains the following:

- Relevant laws and regulations including the Federal Cave Resources Protection Act (FCRPA).
- Cave Management Objectives, Policies, and strategies. In most cases, the “strategy” is taken verbatim from the relevant CFR.
- Karst management goals and objectives. The karst management appendix serves as a standalone document for surface implementation.
- Public Involvement – MOUs in place at the national level between USFS and the NSS.
- Cave Evaluation and rating criteria – allows standardized ratings for data comparison.
- Cave Classification – is based on the evaluation and rating criteria. The Cave Opportunity Spectrum (COS) provides the associated management guidelines.
- Caving ethics – practical training for both Forest personnel and the general public.
- Research proposal guidelines.
- Cave exploration limitation guidelines – cultural, digging, biological, airflow management.
- Inventory procedures.
- Monitoring categories – research and volunteer opportunities.
- Permits and user limits.
- File Management – Content of public files and access protected files.

### **Areas of Discussion**

Most discussions about cave management end up focusing on these three topics at some point. Given the frequency of their discussion, it is no surprise that these topics are subject to a wide spectrum of opinions.

- For timber harvesting, what are the appropriate buffer sizes to allow harvesting while using

disturbance reducing methods? The size and significance of karst features vary greatly. The buffer distances presented represent a strategic guideline. Tactical buffer implementations will vary. The important thing is the buffers are comparable to the other Forest Streamside Management Zones (SMZs).

- Digging to discover caves (entrance digs) and continued passage exploration (in cave digs) are concerns. Forest managers want to maintain control of the resource. They have responsibility for conserving the significant categories.

There is one “shall” in the cave management document: if any cultural artifacts are discovered, NEPA processes will be followed before the dig continues. Also, if a significant cave is discovered, any airflow restrictions should be patterned towards the original dimensions.

The forest service has limited resources for going out to check digs if they have been notified. Dig policies need to allow room for cavers and explorers to discover the resource, while including clear restrictions where needed.

Cleaning equipment and clothing protocols to reduce possible spreading of microbial material from being transported from one caving region to another caving region. Current science shows that sustained washing of clothes and equipment in very hot water (50 degrees C for 15 minutes) greatly reduces the possibility of transporting harmful microbes.

### **Conclusions**

- When caves and karst are present on the forest, they need to be included as a separate land use designation in the Forest Plan.
- Cave and karst management issues are not currently given management priority on most Arizona forests.
- Karst management policies need to be clear and direct. They provide strategic direction for Forest planning activities.
- Karst management guidelines need to be implementable. The guidelines provide tactical direction for day-to-day activities. For example, buffer distances around karst features can vary based on significance, size and terrain.
- Land managers need a document that covers the many aspects of cave management. The document needs to be available when opportunities arise.