

CAVE AND KARST CENTERS OF EXCELLENCE

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Abstract

A Center of Excellence is a concept that brings together state-of-the-art practices, actions, and technologies on a specific topic or subject area. By this definition there are numerous Cave and Karst Centers of Excellence already in existence around the world. Identifying these Centers of Excellence is based on recognizing current activities taking place in that area and their mutual benefit to healthy cave and karst environments, and to the benefit of the people. To achieve this goal, partnerships among governmental agencies as well as academic, non-governmental organizations, private, and international partners can be brought together. These partnerships will help build an infrastructure to raise awareness and foster an understanding of cave and karst resources within a region and around the country.

The goal of a center of excellence should be to enhance resource protection and management through the collaboration and cooperation of the partners and the education of the public. As a Center of Excellence the cooperators focus on objectives that highlight the best management practices of cave and karst resources and their interpretation and environmental education of the public.

Major objectives in establishing a Cave and Karst Center of Excellence are to:
(1) Develop working groups and partnerships focused on cave and karst actions and issues: Cavers, Academia, Governmental agencies, Land Conservancies, and Industry

(2) Foster, concentrate, and develop technical expertise for the protection, conservation, and restoration of caves and karst terrains. Work with local and regional industries and entities to develop the best management practices regarding cave and karst resource uses; Cave Tourism; Logging, Grazing, Oil, Gas, and Mineral Development; Urban Development Projects.

(3) Establish community based tourism opportunities to communicate with and educate the public about cave and karst environments.

Backcountry cave tours, Traveling cave/karst exhibits, Karst maps with educational driving tours, Cave/karst Brochures and videos, Show Cave Development and marketing.

Cave and Karst Centers of Excellence provide recognized leadership to communities and regions. They support local economy in a sustainable manner by educating the public and protecting cave and karst resources.

Introduction

Cave and Karst Centers of Excellence are characterized by their interaction with all aspects of the natural and human environment. This means that

the various aspects of a community, region, and/or broad geographic areas are brought together in an effort to apply the best management and stewardship practices for living on karst terrains.

Caves and karst lands contain remarkable and

often unique resources that add to the richness of regional natural and socio-economic values. Of primary concern in karst lands is the relationship between the surface and the subsurface and the rapid and direct recharge of critical aquifers. An informed and knowledgeable stewardship of karst lands is vital to the protection of its aquifers, the health of its ecosystems, and the prosperity of local communities. Considerations for successful living on karst terrains include its delicate ecosystem and an understanding of the complex nature of karst land forms which require the recognition of special engineering challenges.

Caves can be a major component of karst lands. They contain a variety of resources. These resources include well preserved archeological sites of ancient cultures that predate the modern era, the fossilized remains of unique animals that roamed the plains and mountains over 50,000 years ago or swam in seas known to have covered the land some 260 million years ago. Many caves provide critical habitats for colonies of bats that are important to the agricultural industry. These bats consume literally tons of insects each summer night, protecting crop from pest and reducing the need for pesticide applications. Other animals using the caves make up a unique and very delicate ecosystem that is integrally tied to the surface. Some of these species, such as newly discovered microbes, are proving to be highly valuable in medical research for developing new drugs to combat diseases such as cancer. Other species of microbes are being studied to understand possible links of life on Mars. Research being conducted in caves and karst lands expands our understanding of our geologic, hydrologic, and biologic resources and how our daily lives are affected by living in association with these karst lands.

All of these factors need to be considered when implementing development plans on karst lands and achieving excellence in successful living there. Three primary objectives in establishing a cave/karst center of excellence are:

- (1) Develop working groups and partnerships focused on cave and karst actions and issues,
- (2) Foster, concentrate, and develop technical expertise for the protection, conservation, and restoration of caves and karst terrains,
- (3) Establish community based sustainable tourism opportunities to educate the public about

cave and karst environments.

By incorporating and implementing these three primary objectives into the way communities and regions operate in karst lands the overall understanding of these natural systems in karst lands will increase and the protection of these systems will become a way of life.

Develop Working Groups and Partnerships Focused on Cave and Karst Issues

The ground work of establishing a cave and karst center of excellence is based on recognizing the benefit of a healthy cave and karst environment and its mutual socio-economic benefit to the people. To achieve this goal, partnerships among city, county, state, and federal agencies as well as private and non-governmental-organizations, and international partners should be developed. These partnerships will build a network and infrastructure to raise the awareness and understanding of cave and karst resources in the local communities. Among the groups critical in building such a partnership are speleologists, academia, governmental agencies, and affected industries.

Speleologists often have the best understanding of karst systems. They are on the front edge of cave exploration and the research. They conduct research needed to understand the hydrologic connections in large regional systems and other critical aspects of the karst ecosystem. Speleologists also have the best information on cave locations and inventories of the various resources in the cave. The caving community provides the on-the-ground support needed to carry out many of the projects designed to protect and enhance cave and karst resources. They are the eyes and ears out in the field that can be vital in determining the health of the cave ecosystem over a long term and being able to detect change in the biological communities in the cave systems.

Developing partnerships with academic institutions is of great importance in establishing credible scientific and research data and information bases. Universities and academic institutions with an emphasis in cave and karst studies have focus groups and students that can work on specific projects through cooperative studies and can be set to work on individual issues or on regional problems. Working through a university can provide the long

term continuity for major projects. Funding opportunities through grants can be more easily obtained.

It is essential to form partnerships with governmental agencies at all levels: federal, state, and local. Federal agencies often have large tracts of land containing karst terrain and may need the help of interest groups and subject matter experts to develop karst sensitive management plans. They can also be instrumental in karst land protection by the type of land management policies and direction they put forth.

Municipal and provincial governments may be faced with expanding populations and urban growth on karst lands. Ordinances, building codes, and special design features can be factored into new developments to help prevent environmental problems and preserve a healthy karst ecosystem. In this way the karst ecosystem and the developing human community can both benefit. As agencies begin to understand more about the nature of karst and the integral connection between the surface and the subsurface it will be easier for them to make the right decisions concerning the appropriate use and management of cave and karst resources. Agencies can provide a critical role in promoting proper land use ethics.

A variety of industries may make up some of the primary users of karst terrains. They are critical in the overall mix of cooperators and partners. These industries have the expertise and technical background to know what techniques and operating methods may be applied or developed that will have the least impact and most protection of cave and karst lands. As affected industries begin to understand how their activities can impact sensitive underground resources and create economic risks and safety hazards for local communities they may become more interested in helping develop solutions to the problems.

Develop Technical Expertise to Protect and Conserve Caves and Karst Terrains.

Working with local and regional industries and entities to develop the best techniques and operating procedures for use in regions is vital to successful excellence in living with these terrains. Partnerships can be formal written agreements or can be long-standing cooperative relationships. In either case it is an opportunity to consult with industries

doing business on karst lands and discuss the inherent risks and impacts to their operations and to the long term health of karst terrains and resources. By working with the industrial users on karst lands protection and conservation of cave and karst resources can be achieved.

The oil and gas industry can encounter severe problems while drilling on karst lands. These include the collapse of drilling rigs into shallow cave systems, lost circulation problems, unsuccessful cementing programs, ruptured pipelines due to doline collapse, and others. The industry does not want to encounter these problems. They cost large amounts of money to correct. These operational problems may also cause direct and/or major cumulative impacts to the cave and karst systems. Lost circulation problems, leaking tank batteries and pipelines, and leaching of reserve pit contents can severely degrade groundwater supplies and contaminate resurgences, water wells, and riparian ecosystems. In working with the oil and gas industry a three-phased approach to resolving these problems has been developed.

The first phase is the detection of potential cave or karst features that could be impacted. Detection methods can include field exams, remote sensing, and geophysical methods. The second phase is the avoidance of these features by moving the operation to a less critical location. Where caves are known and have been surveyed the location of passages can be overlaid on surface maps and analyzed. This information can be used to avoid the placement of roads and other facilities over the top of sensitive karst features. The third phase is the mitigation of impacts that can not be avoided. The mitigation can be in the form of special drilling, casing, and cementing procedures and the use of specially designed reserve pit and recovery systems. These should all be discussed and designed in collaboration with the oil and gas industry.

This three phased approach of detection, avoidance, and mitigation can be used with other industrial operation on karst lands. For logging operations in karst lands specific cave entrances, insurgences, and resurgences can be identified and avoided during logging operations. Buffer zones of 200 meters and more can be left uncut around cave entrances and resurgences. This will help protect the water shed entering the cave from large accumulations of silt and slash debris. Another method of

protecting the cave ecosystems are to avoid locating slash piles in dolines and cave entrances. This will ensure the normal and unrestricted flow of water and nutrients into the cave systems and eliminate the accumulation of highly acidic waters entering the system from the leaching of tannic acid from the slash piles.

The grazing and cattle industry can have detrimental affects on cave and karst ecosystems. Cattle often congregate around watering holes such as cave entrances and resurgences. They beat down the vegetation and compact the soils. Additionally, fecal material enters the system and can dramatically change the nutrient and micro fauna makeup of the natural system. Working with the ranching community to fence off these critical areas can help protect these delicate subterranean systems. Water can be piped from the springs to drinkers at alternate locations. Livestock feeders can be located away from these sensitive areas and help disperse the impacts of grazing.

Urban development projects can have a multitude of problems associated with building on karst terrains. Early meetings between speleologists and city and community planners are essential for identifying potential problems and outlining land development codes for karst terrains. Identifying critical areas not to build and creating natural preserves as part of the community development is a basic part of the planning exercise. Mapping the karst features and conducting inventories of resources to determining the best locations for roads, utilities, sewerage treatment facilities, landfills, and other essential infrastructure components is critical. Another essential part of the overall plan should be monitoring systems to tell if the conservation methods are working.

Establish Community Based Sustainable Tourism and Public Education Opportunities

Tourism is an emerging way that communities are diversifying their economies. Tourism must be designed to take advantage of the positive aspects a community has to offer and not to merely open their doors to anyone that wants to drop by. This means to consciously look at the resources they want to showcase and develop strategies and plans that can successfully offer these resources without

degrading them over a long period of time. This is what sustainable tourism is. The other essential part of the tourism package is the community. It is important to ensure the involvement of the community when developing such a tourism economic development package. If the community is part of the overall picture everyone will benefit. The spin-off businesses such as hotels, restaurants, guide services, and others provide a broader base of community involvement and ownership while generating its economic returns. Several types of tourism packages can be offered that attract visitors with a variety of skill levels and interests.

This is the case in the Ipporanga area of Brazil. The primary economy of the local community had been logging until the government stopped all logging in the area to protect some of the endangered trees in the area. Without the logging industry the local community looked to their other natural resources for a source of income. With an abundance of world class caves they began conducting cave tours. As visitors came in, the community began to develop hotels, restaurants, and shops to support their emerging tourist industry. This new industry involved a large portion of the local community and provided them a steady source of income that was spread throughout the village. Some of the hotels have Web sites and do a good job of advertising and promoting cave conservation. By working with the local guides and giving them factual resource information about the caves and karst systems of their area the guides were able to modify the content of the talks they gave to visitors and pass along more environmental messages about their natural resources. The guides also gained a greater understanding of the cave and karst systems and a better appreciation of the resources. This higher level of understanding and appreciation then translates into better protection of the natural systems that provide their village its economic support. The entire community is involved with the karst lands and have a vested interest in their protection and health.

Through conscientious and careful advertising, messages about the importance and fragile nature of caves and karst lands can be passed on. Information about responsible land use ethics and the interrelationship between the surface and the subsurface can be interpreted. Information about how to safely explore and enjoy the world beneath

our feet can be explained. This will also help reduce accidents, fatalities, and misadventures of visitors. Working in partnership with a local tourism office provides a wide array of advertising and communication media not available to individual businesses. This media exposure would assist tourism interests in showcasing certain caves, and pass on information about responsible land use ethics associated with karst resources.

Backcountry cave tours can offer a special type of tourism aimed at the more physically active visitor. They provide a unique and personal way of relating important information to visitors. Local guides can give the tours and inform the visitor about the local customs and uses of the caves in the area. Interpretive information can be given to the visitors to aid in their understanding of the natural ecosystems and the importance of the karst resources to them. This is an opportunity to put into practice many of the principles of cave conservation and ethics. Trails leading to the caves and trails through the caves can be developed to minimize the cumulative impacts of foot traffic. Important concepts of leaving what you find and not disturbing the native wildlife and speleothems can be explained to the visitors.

Traveling cave and karst exhibits give people an opportunity to learn about caves and karst terrains in a more structured setting. Information can be presented in a controlled environment and in a more ordered fashion. Schools and communities can take advantage of traveling exhibits as part of basic education and community involvement programs. Many people can be reached through the use of exhibits that may not otherwise visit a cave or have the opportunity to learn about the relationship between the surface and the subsurface in karst lands. Traveling exhibits can be exciting and interactive with a variety of interpretive messages. Traveling exhibits can be large structures requiring elaborate set up and multiple speleological themes or they can be as small as a table top display. In either case they are sources of public interest and provide a focus on the ecosystems beneath our feet. They provide an opportunity to interact with an interested public and transfer important information about healthy living on karst lands.

Educational karst driving tours with karst maps that explain the features being seen is a good way to introduce people to the ideas of karst terrains on

a regional scale. These can be developed and promoted throughout large areas and give the visitor a broad understanding of how the systems are tied to one another. These tours can be tied to geologic and cultural aspects of a region's history. A karst travel guide and information brochure can be developed through a collaborative effort between the local communities and the regional geological survey to produce a karst map with points of interest. The karst map and brochure could provide the visitor with the basic information about the different kinds of caves and karst lands in the region. Additional information could tie in the various aspects of karst lands and their importance to groundwater recharge, wildlife habitat, cultural heritage, and geologic interpretation. Audio cassettes and CDs can also be produced to go along with the maps.

Cave and karst brochures and publications are vital ways to get information across to the visiting public. They can present quick informative messages or detailed information on complex issues. Brochures provide an inexpensive way to help advertise and attract visitors to an area. They can give information on what is available to the tourist and what they can expect. The basic information of what is available, where it is located, whom to contact, and how much it costs is easily conveyed in a brochure. A colorful and well designed brochure can be a powerful advertising tool as well as being an instrument for disseminating conservation messages and basic safety practices. More detailed publications can provide the space for a larger story about caves and karst resources. They can give an in-depth look at the interrelations between the surface and the subsurface. Special publications can describe the specific geology, biology, hydrology, and cultural interests of the caves and region.

Show caves are the crown jewels of a karst area. They can attract large numbers of tourists and provide an underground experience to the general public with little risk and effort. Show cave tours can provide a wide variety of interpretive messages and give the visitor of what it is like to be inside Earth. A show cave experience has the potential to inspire visitors to know and understand more about caves and karst terrains. They can be exciting and educational. Development of good marketing plans through partnerships with other cave and karst related enterprises will help round out an overall package for successful karst tourism. Mar-

keting strategies can include Web sites that provide information about caving interests and available tours and contacts. These Web sites can be linked to tourism Web bases with information about accommodations, restaurants, and links to other cave based Web sites that connect the visitor to local caving organizations, cave conservation organizations, and virtual cave web.

Conclusions

Cave and karst centers of excellence develop through partnerships in local communities and industries to raise the awareness of how caves and karst terrains affect our daily lives. Their goal is to enhance the protection and conservation of cave and karst resources through educating the public on how to balance surface uses with subsurface connections and ecosystems. Areas working towards this state of excellence utilize the experience and

expertise of local industries to help solve problems associated with development on karst terrains and offer avenues for communities to realize economic benefits from their cave and karst resources that are compatible with the long term protection of those resources. To implement the concept of a cave and karst center of excellence the first step is to Identify the primary partners in the area. Second is through collaboration with the partners identify the major issues and threats to karst lands and community development. Third is identify opportunities for collaborative problem solving. Forth is to identify areas to engage the public in cave/karst education and tourism opportunities. The partnerships and working groups that are developed must be kept viable and in constant communication if a true excellence of living on karst lands is to be achieved. The health and prosperity of the community and the karst is at hand.