SUPERIOR KARST STEWARDSHIP THROUGH SUPERIOR DATA MANAGEMENT: THE KARST INFORMATION PORTAL

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Abstract

Effective stewardship of caves and karst areas requires access to and efficient analysis of a diverse range of information. Vital data are scattered throughout specialty mainstream journals, which even for a single project could include fields such as ecology, hydrogeology, contaminant transport, toxicology, engineering geology and law. Additionally, volumes of crucial information often lie in difficult-to-find gray literature. Management recommendations and decisions should be based on assessments of state-of-the-art information, but fall short when important patterns and relationships are overlooked.

The Karst Information Portal (KIP) offers a solution to these problems. Conceived in 2005 and launched in June 2007, KIP grew as a partnership among the International Union of Speleology, National Cave and Karst Research Institute, University of New Mexico, and University of South Florida. Key features complete or in development include:

- Federated searches of Web sites for more efficient and reliable location of key research papers and information,
- A searchable database of multidisciplinary karst information,
- A library of on-line karst papers, reports and theses,
- A collaborative international on-line workspace to post and evaluate images, maps, databases, and other published and unpublished information.

Like other virtual research portals, KIP will continue to grow as existing and future partners contribute information by plugging Web sites and databases into the network. KIP will not duplicate existing databases but will more efficiently access and process them with superior tools. Additional partners can help fulfill

KIP's potential in revolutionizing cave and karst stewardship through advanced and collaborative integration of data and ideas.

Key words: web-based karst information, bibliographies, databases, on-line literature, cave management

Introduction

The stewardship of karst areas and resources is a complex, multi-disciplinary task. Species management often depends on both broad and specific ecosystem and hydrological analyses. Protection of karst water quality and contaminant remediation can require understanding of intricate chemical reactions and biological attenuation processes, and the delineation of drainage basins and convoluted flow paths. Archeological materials require sensitivity to diverse cultural concerns. The potential for paleontologically significant deposits is evaluated relative to geological and other factors. Constructed management structures are engineered to preserve natural conditions despite occasional conflicting needs and on a landscape of uncertain stability. This all occurs concurrently relative to available information, human and resource needs, and impacts in surface, subsurface and legal/legislative environments.

Ultimately, successful stewardship depends in large part on access to karst-specific data and knowledge. This knowledge might come in the form of published scholarly articles, unpublished government or technical reports, cavers' maps and notes, or even oral histories. Regardless of form, much of the existing knowledge of karst resources is fragmented and scattered all over the world, in particular, important cave information is often maintained by amateur speleological clubs that may lack the resources or the inclination to make that data available to the wider karst community. Unless this knowledge can be integrated and linked, issues of environmental degradation related to karst will be difficult to address without significant duplication of effort.

The Karst Information Portal (KIP)—a joint project of the University of South Florida libraries, the National Cave and Karst Research Institute, the University of New Mexico, and the Union Internationale de Spéléologie (UIS), with significant support from the Dr. Kiran C. Patel Center for Global Solutions at the University of South Florida—was developed and implemented with the intent of addressing this problem. KIP is aggressively acquiring karst-related content, with an emphasis on gray literature and raw data that have historically proved to be difficult for researchers to locate and access.

What Is KIP?

Conceived in 2005 and rolled out in mid-2007, KIP's goal is to foster the integration of karst knowledge by providing a comprehensive, community-driven central repository of this knowledge, including gray literature, raw data, and published journal articles. It is both a web portal, in that it provides connections and links to information and data available elsewhere on the World Wide Web, and a database, in that it stores some data locally, which can then be downloaded by portal users. Researchers and community members contribute content to KIP's catalog via a browser-based form, they can also share information regarding events, deadlines, and current research between themselves. As of November 2007, KIP's catalog contained over 4,000 items, including journal articles, reports, abstracts, databases and bibliographic data.

This "one-stop" approach to information access has at least two immediately apparent benefits. First, it facilitates research by providing access to the existing body of karst literature, including the oft-elusive gray literature. Second, it ensures long-term electronic access to these information resources. Additionally, formerly catastrophic events, such as a library fire or flood, no longer pose the threat of depriving the karst community access to information stored on a library shelf.

How KIP Works

KIP (http://www.karstportal.org) is a browser-based, platform-independent application with a design goal of facilitating open access to quality karst-related information. Everything from the

user interface to the underlying database has been organized in a way to make it easy for users to both discover and contribute information. Navigation within the portal is conducted via a series of tabs, each providing access to a different content group, and is facilitated by static links in the footer:

- The ***About*** tab contains a listing of project partners and an array of project documentation, including brochures and user manuals. The content displayed here is largely static.
- The ***News*** tab contains announcements of upcoming karst-related events, new publications on cave and karst science, and important research updates. These items are updated as they are forwarded to KIP administrators. Users can subscribe to an RSS feed (**R**eally **S**imple **S**yndication) that will deliver updates to them as they are made.
- The ***Resources*** tab contains the "information core" of the entire KIP project. This is where users may access the catalog, which contains databases, theses and dissertations, maps/GIS information, cave and trip reports, technical reports, images, periodicals, oral histories, proceedings and abstracts, among other items. Ultimately, KIP's goal is for most portal users to actively participate by contributing work or raw data to the catalog, where it can be readily accessed by other members of the cave and karst science community. All items contributed by users must first be vetted by KIP administrators, in order to guarantee that each item in the catalog meets or exceeds a minimum level of relevance to the karst community at large. Users also have direct access to current and archived content for several online karst-related publications, including *Speleogenesis*, *Journal of Cave and Karst Studies* and *Acta Carsologica*, among others.
- The ***Community*** tab provides access to features that are intended to build personal and professional linkages among members of the cave and karst communities. Most notably, users can use the ***Forum*** to initiate and participate in conversation threads on a wide range of karst-related topics. The Forum is open to all registered users of KIP.

KIP provides several methods for information search and retrieval. Most pages feature a context-sensitive "sidebar" that offers a list of related links. Additionally, items in the catalog are assigned tags to facilitate one-click searches for related items in the catalog. KIP also incorporates a powerful search utility that enables users to conduct federated (simultaneous multiple-source) searches of the entire portal, or to conduct a more focused search within a particular section of the portal (i.e., the catalog, the forum, or news). Searches for information outside the KIP are customized to focus on karst-related Web sites to maximize the likely relevance of the results. Searches may also be refined based on geographic location, document type, language of resource, or the inclusion of specific terms based on UIS Speleological Subject Classifications.

Most items stored locally on KIP servers are recent (i.e., generally less than ten years old). This is due in large part to the fact that many older resources have never been digitized. In cases where copyright issues can be successfully negotiated, older resources will be scanned and uploaded to the portal catalog, certainly, copyright holders can hasten this process by scanning and uploading the resources themselves. Several digitization projects are either in progress or under consideration, including digitizing back issues of the *NSS News*.

Users are strongly encouraged to register with KIP, a process that can be completed from the portal's main page. While it is not mandatory to register in order to access information within KIP, registration brings with it the ability to contribute to the collection and to participate in the community-based features of the portal. KIP managers consider the portal's collaborative and community-building aspects to be among its most important features, as more and more users register, these features will become more robust.

KIP's Collaborative, International Nature

KIP's collaborative nature and international reach make feasible its goals of a centralized access point to karst information and developing broad connections between people within the karst community. Several projects driven by or associated with KIP draw upon its collaborative features. Examples follow:

- The Karst Oral History project is a series of interviews, conducted with prominent figures in

the world of cave and karst studies, which are transcribed and posted to the portal along with the raw audio recordings. The purpose of this project is to preserve the experiences and observations of major figures in the cave and karst community, in their own words, so that future students of karst might be able to benefit from them. As of November 2007, four oral histories have been conducted: Jeanne Gurnee, Dr. William Halliday, Dr. Alexander Klimchouk, and a joint interview of Drs. Elizabeth and William White.

- The Scanning Electron Micrograph (SEM) database contains over a thousand SEM images. This project was created by DSpaceUNM to collect and index SEM images of microbial organisms and related structures and make them available for international collaborative review and study. Interested researchers are able to examine all of the metadata, comment, and post their own images.
- Currently in the planning stages, the Great Karst Trail is an effort to build an online trail system in which users contribute locations of trails in karst areas worldwide. This system will also be interactive, as each trail segment will be assigned links to research articles, images, or any other relevant information. The Great Karst Trail will also incorporate a *wiki* (a webpage-generating database that can be expanded and edited by users), designed to permit KIP users to comment on or refine information about the trails contained therein.

The Role of KIP in Cave and Karst Management

Cave management is only one segment of the larger karst community, the broader focus of KIP reflects that diversity. Given that, cave and karst managers might wonder how KIP can help advance the level of knowledge and understanding within their discipline.

First, the number of items in the catalog that address management-related issues is growing steadily. As of November 2007, searching the word "management" in the KIP catalog returned 217 records, a search on the phrase "cave management" returned 51 hits, while 28 records were returned for a search on the phrase "management plan." In many cases, direct access to these resources is available. When direct access is not available, each record returned provides bibliographic information for the resource in question, so the KIP user may locate it on his or her own. Examples of directly-accessible, management-themed resources within KIP include an examination of bat hibernacula in the karst of central Manitoba (Bliecki 2003), discussion of cave protection in national parks (Kerbo 2002), changing management perspectives at Carlsbad Caverns National Park (Burger and Pate 2001), the role of GIS technology in cave management (Olson 2001), and New Zealand's federal karst management guidelines (New Zealand Dept. of Conservation 1999). This is not a comprehensive listing of directly-accessible resources, but a representative, random sample of cave-management-related resources within KIP. The number of government publications, journal articles, conference proceedings and theses and dissertations addressing management issues is growing steadily as word about KIP gets out among the karst community. In particular, the KIP management team is hoping to increase the number of conference proceedings stored in or accessible from the portal. Proceedings can be notoriously difficult to access online. Currently KIP is in the process of adding proceedings from the National Cave and Karst Management Symposium (NCKMS): as of May 2008, materials from the 1999 through 2005 NCKMS proceedings are available directly through the portal.

Second, the diversity of karst-related information contained within KIP is often indirectly relevant to cave management issues. Karst systems are not closed systems, for that reason, cave management issues do not exist in isolation. In addition to the cave management-specific information available, KIP brings together an array of literature and data from other branches of karst research that can shed light on management-related issues (for example, land use in karstic terrains).

Finally, KIP works to facilitate information sharing and to open lines of discussion among the cave and karst management and science community, regardless of where users are located. Because KIP works across international boundaries, there is no reason that the international nature of cave information should continue to pose significant challenges to researchers. KIP also provides one-stop access to all types of cave and karst management information: examples currently contained in KIP

include theoretical ideas of resource management, up-to-date first-hand knowledge of cave systems (extent, conditions, location, etc), and examples of existing approaches to cave management in diverse areas throughout the world.

Conclusions

KIP is an international, collaborative, browser-based tool linking karst researchers and cave enthusiasts with data, information and each other. Its benefit to cave management professionals is threefold: it provides access to management-specific information, to other related information that can help facilitate the growth and development of new ideas and approaches, and to other professionals who may be able to provide insight into solving the problems and challenges of cave management.

Put simply, KIP's ultimate contribution to cave management studies are to make it easier to determine what works, what does not work, and what might work by providing a centralized tool with which to mine the past experience of an entire community of experts. However, as with any collaboration-based project, the overall effectiveness of KIP as a tool to accomplish this significantly depends on the participation of the cave and karst community, through the content it will provide.

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