Synthesis as a Law Enforcement Tool at Shenandoah National Park: A Synthesis Regional Support Center Case Study

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Synthesis is an information management tool for efficiently organizing, integrating, and disseminating data and information. Synthesis presents users with an easy-to-use graphical user interface that functions as a gateway to information that may be stored on local computers, networks, intranets, as well as the internet. From this single gateway, a user may view and integrate many types of information, including text-based documents, photographic libraries, databases, spreadsheets, presentation graphics, GIS (geographic information systems), bibliographies, internet-based information, and decision-support systems. The Synthesis Regional Support Center (SRSC) at James Madison University (JMU) in Harrisonburg, Virginia, was established in late 2001 to support national parks in their use of Synthesis for information management. The SRSC's first customer, Shenandoah National Park, provided documents and guidance for the development of ginseng (discussed herein) and bear gall databases intended to support special park agents and criminal investigators with both research and law enforcement for threatened natural resources.

Synthesis began life as a "hard-wired" air-quality information management system. Its capabilities were gradually expanded and enhanced to accept all types of information from any subject area. Eventually, because of the broader nature of the system, it was decided that the system should be moved to the National Park Service (NPS) Natural Resource Information Division (NRID), which happened in March 2000.

The NRID is part of the Natural Resource Program Center, administered by the NPS associate director for natural resource stewardship and science. It maintains offices in Fort Collins and Denver, Colorado, and Washington, D.C., and consists of three branches.

The *Inventory and Monitoring Branch* documents the status and trends of natural resources in America's national parks. It oversees inventory and monitoring programs throughout NPS. It assists parks, regions, and other NPS offices in the acquisition of natural resource inventory and monitoring information and in the application of this information to management decision-making and resource protection.

The *Systems Management Branch* provides and administers servicewide databases to meet the needs of natural resource program managers. It also develops and maintains data processing tools and procedures to help park staffs manage natural resource information consistently.

The *Information Services Branch* develops and communicates information for the preservation, management, and understanding of park natural resources. Informational

materials and services are geared to reach the public, park staffs, and NPS partners, and include education, interpretation, and public outreach programs.

The Office of the Division Chief, through the natural resource web manager, coordinates and manages NPS natural resource web activities. This includes overall coordination of NatureNet and the Natural Resources Intranet, leading the interdisciplinary Natural Resource Web Team, and coordinating guidance and policy recommendations on natural resource web publishing.

Law enforcement and compliance actions in NPS are managed by park superintendents. Specially trained rangers provide emergency services and uniformed resource protection. A small cadre of criminal investigators focuses on long-term resource crimes or those which require extensive investigation to halt the resource harm and to restore the resource. Planning and prioritization of enforcement and compliance actions is conducted at the park level, in conjunction with resources specialists. Superintendents and chief rangers from Great Smoky Mountains National Park, Blue Ridge Parkway, and Shenandoah National Park have determined to engage in shared evaluation, response planning, and active protection when resources held in common are threatened.

In 2000, the three parks engaged in a cooperative project to identify, quantify, and mitigate the risks to ginseng *(Panax quinquefolius),* galax *(Galax rotundifolia),* and three other medicinal herbs. The resource risks are a result of large and escalating international markets.

Early in the project, rangers and agents identified the absence of an extensive, shared data set among resource-serving agencies. A common data set, shared among agencies with common missions, would serve as a conservation tool in itself. It would also facilitate the development of additional protective methodologies. Preliminary data gathering showed that a large body of information resided in several federal and state agencies; however, the information was paper-based and lacked continuity. No common links of information were found between the several agencies charged with making decisions on the protection of these species.

Having determined that a common data set was a primary protection tool, law enforcement planners, with the support of the NRID, selected Synthesis as the information management tool. Documents were sent from Shenandoah, Great Smoky Mountains, and Blue Ridge to the SRSC at JMU to be introduced into the database. NPS special agents provided NPS supervision of the project. The ginseng database developed for Shenandoah in response to this need is now a collection of well-organized, easily accessible, and searchable electronic documents containing information on ginseng and other protected or endangered plant species. Ginseng topics include, but are not limited to, biology, population surveys, import/export data, conservation programs, and regulations. A limited number of documents on endangered plants other than ginseng has been included.

Several evolutions of data organization were modeled for the end user. Eventually, a structure that mirrors the thought process of conservation enforcement professionals was constructed. The primary divisions are *Species Status*, *Threats to Resource*, and *Protection Tools*.

Species Status is first on the outline because it is the first thing that a conservation law enforcement officer will seek to determine. If resources are stable, further investigation is unlikely. By looking at the habitat requirements of the ginseng, the surveys documenting its locations in the park, how humans have used ginseng in the past, and ginseng population dynamics, the officer, in consultation with resource scientists, will be able to quickly assess whether enforcement action and/or other conservation tools are required.

Once a preliminary determination of resource risk is made, the next logical step to take is to assess and quantify threats to the resource. Hence, part two of the outline: *Threats to Resource*. Under guidance from law enforcement personnel at Shenandoah, several topics were discussed for inclusion in the outline. International trade reports, local and

foreign price lists, import/export data, prior criminal cases, and documents on hunting, finding, and digging medicinal herbs were found to be top priorities. These provide important conservation information on exploitative methods and motivators, and insight into complex derogation patterns.

Reports on international trade can identify locations in the park from which foreign markets are receiving medicinal herbs. Price lists of ginseng in local markets can help identify where these herbs are bought for the highest cost, thus poached the most. Import/export data can help law enforcement officers locate areas around parks where the most herbs are being sold. Prior criminal cases will store information on past poachers, so if an officer crosses paths with someone on the list, closer attention can be paid to that individual. Many companies are in the medicinal herb business. Some of these companies wish to educate citizens about how to attain specific herbs such as ginseng by giving workshops, holding meetings, or even distributing brochures. The last portion of the outline stores information on these topics.

The third and final portion of the outline, *Protection Tools,* provides law enforcement officials the toolkit needed to design and implement interdisciplinary protection plans. Listed first are conservation programs that have been created to protect medicinal herbs and other resources. The next section offers a collection of laws and regulations from across the country that focus on policies regarding the protection of these resources. Last on the list is what may be the most important part of all the documents: public education. These documents are used to educate the public on every aspect of the medicinal herb trade. There is a wide range of conservation tools, laws and regulations that may be improved. Current ideas include marking techniques involving tracing technology and replanting techniques to further enforce restrictions.

For electronic conversion and data conditioning, each paper document was scanned in conjunction with OCR (optical character recognition) technology, then indexed for metadata and keywords. In the process of scanning, each document is converted to a JPEG (.jpg) image. OCR is used to correct scanning errors, to repair damaged documents, and to transform documents into keyword-searchable files. As each document is successfully converted and conditioned, it is added into an organized tree index of relevant categories. Documents are easily accessed through the tree, or identified through keyword searches of files and metadata. Currently, the ginseng database contains approximately 280 documents.

Each document has its own metadata file that can be accessed to allow evaluation without opening the actual file. Metadata are pieces of information about the file that include author, date, title, publisher, and a description—basically all information that is essential if the file is to be useful as a reference. The metadata for Synthesis are based on Dublin Core, an international metadata standard.

Keyword searching is done either with a full-text algorithm or by using pre-assigned keywords. Assigning keywords, which requires careful reading of each document, is a time-consuming task for Synthesis specialists. The full-text search function was recently implemented in Synthesis and saves a great deal of time in database development; however, manual keyword indexing can still be advantageous in law enforcement and can be done at the prerogative of the customer. The ginseng documents have all been manually indexed. Full-text capability is an option in either case.

The outline of the Shenandoah ginseng database is shown in Table 1, with the number of documents for each category in parentheses. When clicked, a category reveals additional cascading categories and the actual document titles. The documents in each category have been qualitatively assessed and sorted by order of importance/relevance. More important documents are placed at the top of the list under each category.

Shenandoah's ginseng database is a work in progress. It is expected to be implemented by the park's special agents in 2003. The SRSC at JMU will provide on-going support

Table 1. Outline of the Shenandoah National Park ginseng database

Species Status (71)	*Laws and Regulations*
Ginseng	International (0)
Biology and Habitat Requirements (10)	National (10)
Population Surveys (18)	*State*
Historic Human Uses (15)	Arkansas (2)
Scientific Studies (12)	Georgia (3)
Other Protected/Endangered Plant Species (16)	Iowa (2)
Threats to Resource (57 total)	Kentucky (3)
TRAFFIC Report on International Trade (2)	Maryland (3)
Price Lists	New York (2)
Foreign (0)	North Carolina (5)
Local Markets (18)	Ohio (2)
Import/Export Data (16)	Tennessee (2)
Prior Criminal Cases (0)	Virginia (3)
Hunting/Finding/Digging Ginseng (21)	Wisconsin (2)
Protection Tools (142)	Others (4)
Ginseng Conservation Programs	Cases and Rulings (10)
International (3)	Plant Marking Techniques (1)
National (19)	Plant Replication Techniques (11)
State	Public Education (18)
Indiana (3)	Miscellaneous Documents (10)
Kentucky (2)	
North Carolina (6)	
Tennessee (2)	
Virginia (9)	
West Virginia (3)	
Others (12)	

and management as more information is revealed. The capabilities of the Synthesis Information Management System will allow for continued expansion of the ginseng database. In addition to new documents, the database will handle GIS information, which may contain different data types ranging from photographic libraries to spreadsheets to internet-based information.

The SRSC at JMU also functions as a conduit between users and program designers. The full-text search engine referred to earlier, as well as improvements to metadata functionality, were constructed in response to needs identified by the agents and rangers, communicated by SRSC specialists to Synthesis system designers and programmers. Other functions of the SRSC include training park personnel to create, maintain, and use their own databases; providing support for such efforts; and, most recently, developing multimedia interpretive VIEWS of the national parks. Parks served to date, in addition to Shenandoah, are Fort Sumter National Monument and New River Gorge National River. The New River Gorge work will support future general management planning. The newest partnership, with Lava Beds National Monument (Klamath Network), is scheduled to begin summer 2003.

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